FLIGHT
and
AIRCRAFT ENGINEER

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The Outlook

Back to Methuselah

HOW far away seem the days when there was no such thing as air power! Yet in point of time it is only 37 years since the first faltering steps were taken to lay the foundations by founding the Royal Flying Corps from which was to grow the Royal Air Force and all that that has meant to the nation and to the world.

When that momentous event happened, on April 12th, 1912, *Flight* had already been in existence for more than three years, the first issue having appeared on January 2nd, 1909, the frontispiece picture showing Mr. J. T. C. Brabazon (now Lord Brabazon) flying a Voisin biplane which looked rather like an animated bookshelf. British Government encouragement of flying had been to all intents and purposes non-existent until the Royal Flying Corps was founded, and the pioneers were private experimenters who spent their own and their friends' money on what appeared to most people mad adventures. But they persevered, and ultimately the Government could no longer disregard the need for military preparedness in the air.

The Royal Flying Corps was formed initially with two Wings, a Naval Wing and a Military Wing. The first few pilots of the former were trained at Eastchurch, where Mr. (now Sir Francis) McClean had lent two of his private aircraft. Pilots of the Military Wing were trained at Farnborough, where was established the Air Battalion of the Royal Engineers. Later a common training centre, the Central Flying School, was established at Upavon on Salisbury Plain. The Military Wing was administered by the War Office, the Naval Wing by the Admiralty.

Just how small were the beginnings can be realized when it is recalled that the initial establishment for the Military Wing was seven squadrons, each with 12 aircraft and 182 pilots, half of whom were officers and half N.C.O.s. A similar number were in reserve. There was a less clear picture of what the Navy would want in the way of aircraft and so the requirements were less specifically stated.

The rates of pay, per day, were: a squadron commander 25s, a flight commander 17s, a flying officer 12s. In addition all received an extra 8s a day flying pay. For other ranks the rates were: Warrant officer 9s, sergeant 6s, first-class air mechanic 4s, second-class air mechanic 2s. Yet, as Sir Philip Joubert stated in a recent article, they lived "like fighting cocks."

Feeling Their Way

THE Army was fairly certain of what it wanted. The purposes for which aircraft would be used were laid down as follows (the order of importance is noteworthy): "reconnaissance, prevention of enemy's reconnaissance, intercommunication, observation of artillery fire, infliction of damage on the enemy. The Navy, on the other hand, could not yet quite see what use these newfangled contraptions would be, but the following quotation from the official Memorandum is illuminating:

> "It is impossible to over-estimate the importance of experiments for the development of hydro-aeroplanes [that was what we called seaplanes in those days], and in flying from and alighting on board ship, and in the water under varying weather conditions. Until such experiments have proved conclusively how far such operations are practicable it is impossible to forecast what the rôle of aeroplanes will be in naval warfare, or to elaborate any permanent organization."

However, the memorandum went on to state that steps had been taken for the purchase of twelve aeroplanes, hydro-aeroplanes and floats for first requirements.

The Naval Wing of the Royal Flying Corps broke away in 1914 and became the Royal Naval Air Service.

On April 1st, 1918, the two Services were amalgamated into the Royal Air Force.

These reminiscences are the outcome of the reunion of members of the R.F.C. and R.N.A.S. held in London last week. The fact that many of those who helped to lay the foundations of air power attended the function is an indication of that gift of apparently everlasting youth which aviation appears to confer on its devotees. As Lord Tedder said, "I doubt if one per cent of you have grown up, or ever will."

Reliability

"SEALED service," the ideal state of affairs in which components of aircraft and power plants need not be touched until their pre-determined life has been reached, appears to have been brought one step nearer by the second 500-hour run accomplished by the de Havilland Goblin which last year made a similar run under "combat-sequence" conditions. All told, this Goblin has stood up to 924 operational cycles, each of 1 hour 15 minutes and comprising periods of running at idling, taxying, take-off, maximum climb, maximum cruise, and combat conditions, with a number of violent accelerations and a standby period of ten minutes, thus introducing rapid changes of stress and temperature.

From the operational point of view, the amazingly small number of man-hours required for maintenance is of great importance in that the period of unserviceability will be reduced almost to vanishing point. Just what it means in the R.A.F. is illustrated by the statement made some time ago by Air Vice-Marshal Cuckney that for 500 hours' running under similar conditions the high-power piston engine would require some 1,286 man-hours for maintenance compared with 13.2 for the first 500-hour run of the Goblin. Such figures should cheer not only the R.A.F. but the European nations which have chosen the Goblin-powered Vampire.

In civil application the reliability of the Goblin will no doubt be repeated in the Ghost which is to power the D.H.106 Comet airliner. That should mean that civil operators of the Comet will be able to achieve a very high utilization by the minimum of power-plant maintenance time and quick turn-round. Unfortunately, there are many items in the equipment of an aircraft which can render it unserviceable, and until these have been brought to the same state of perfection, much time can be lost.

The fine example set by the de Havilland Enterprise should encourage designers and manufacturers of other equipment to strive for comparable reliability.

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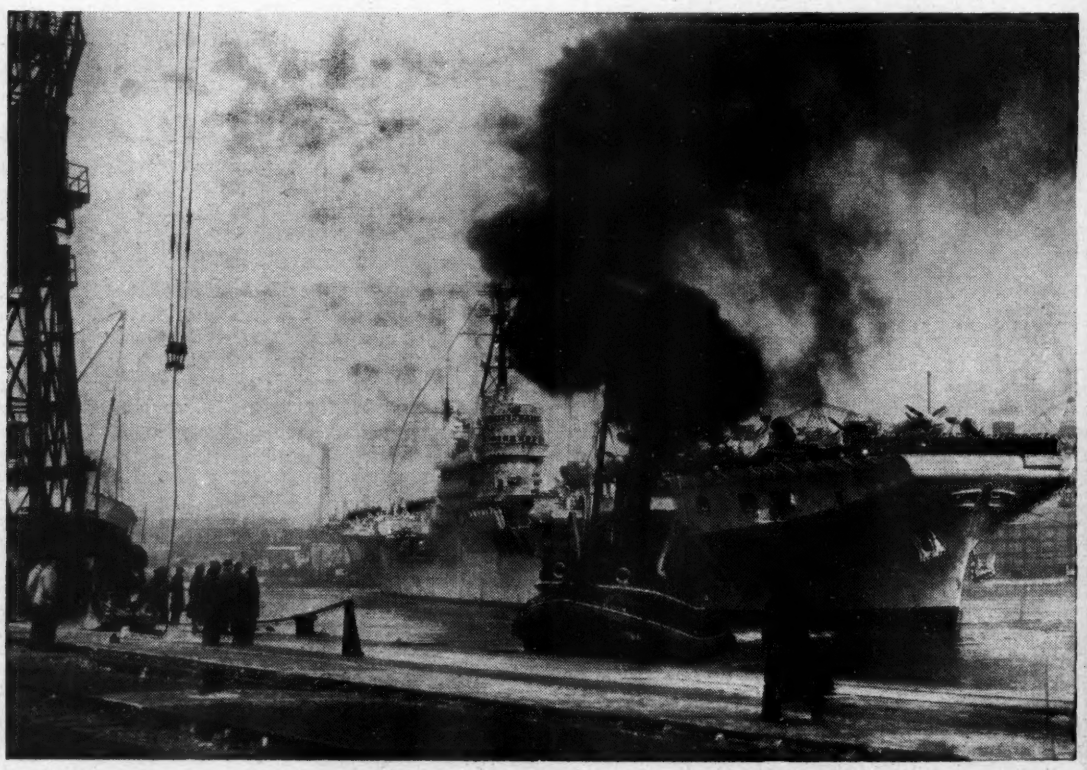


PAYING OFF: With aircraft ranged and crews lining the decks, the aircraft carrier H.M.S. TRIUMPH is escorted into the King George V docks, Glasgow, after an absence of two years. The long paying-off pendant may be seen flying from the mainmast.

Express Delivery

First B.O.A.C. Canadair Arrives Two Months Ahead of Schedule

A SEQUEL to the story of Canadair's splendid production effort, told in *Flight* of February 24th and March 3rd, was the arrival at London Airport, on March 23rd, of the first of twenty-two Canadair Fours for B.O.A.C. The contract specified delivery by May 30th—a clear two months ahead. Early to visit the most welcome newcomer were Mr. Lindgren, Parliamentary Secretary to the Ministry of Civil Aviation; Sir Harold Hartley, chairman of B.O.A.C.; Sir Miles Thomas, chairman-designate; Mr. Whitney Straight, chief executive; Mr. J. W. Booth, a member of the B.O.A.C. board; and Mr. A. C. Campbell-Orde, director of technical development. Passengers on the crossing were Mr. H. Oliver West, president of Canadair; Mr. R. A. Neale, vice-president, manufacturing; Mr. Campbell-Orde, and Captain Peter Cain, B.O.A.C. The crew were Capt. A. J. Lilly, chief pilot, Canadair; Capt. Anglin, assistant chief pilot; S. Harris, flight engineer; W. Freeman, navigator; and A. Ramsay, radio operator.

Except that it bore no name, the aircraft was finished with full B.O.A.C. markings, the registration G-ALHC, lettered on the fin, setting a new style for British-operated transports. With the internal "cross-over" exhaust systems, the "Four" will present a particularly trim appearance. The interior is likewise attractive in its neatness of layout and finish; dark blue seats contrast with light grey walls and with gay red and grey curtains of floral pattern. Entirely blue, the rear lounge is perhaps a shade on the sombre side, and both Sir Miles Thomas and Mr. Whitney Straight agreed that the introduction of some lighter fabric would be an improvement.

Particularly gratifying to Canadair and B.O.A.C. is the great weight-saving effected. The first production aircraft came out 941 lb, and the second 972 lb under weight. Wisely, the Corporation had allowed a tolerance of 950 lb, so a total of 1,900-2,000 lb will now be at their disposal.

Very satisfactory reports on handling and performance, said Mr. Whitney Straight, have arrived from ex-Constellation pilots of B.O.A.C., at Montreal for training and familiarization. He regretted that a year of discussion and argument had delayed the Canadair order and that the new machines should not already have displaced those costly stalwarts, the Yorks and Lancastrians.

The amount of British equipment embodied is agreeably surprising, and Canadair point out that, as home-supplied

"*Flight*" photographs.

Laid out to B.O.A.C. requirements, the cockpit of the Canadair Four presents an orderly appearance and is well thought of by crewmen. Instruments include a Sperry Gyrosyn compass and electric gyro horizon, Hughes compass and periscope sextant and Smith's A.S.I.s and clocks. Above are Capt. Al Lilly and Capt. Anglin, of Canadair

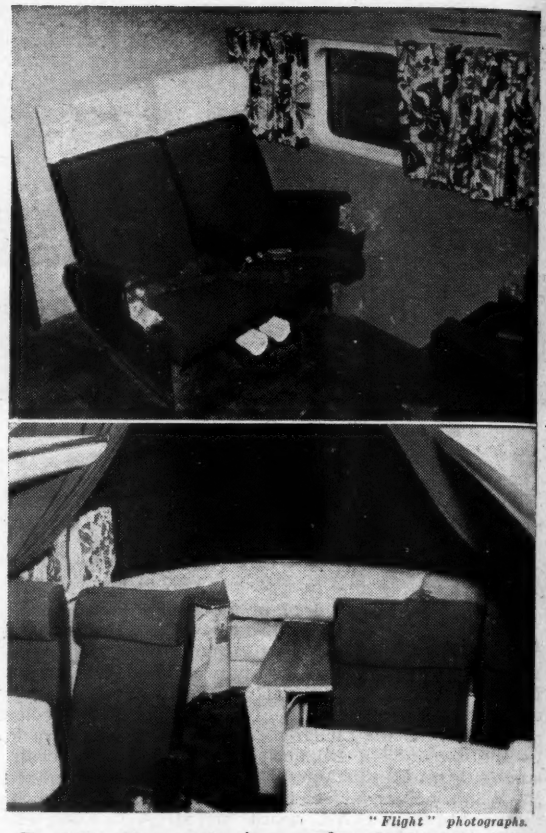
items constitute the relatively expendable portion of the aircraft, the "United Kingdom content," in terms of original cost plus maintenance cost, is very large. Over the life of the aircraft, at B.O.A.C. utilization level, the sterling cost will equal, or exceed, the dollar expenditure.

Complete power plants, with their gearboxes, S.U. single-point fuel-injection pumps, Rotax electrical equipment, Lodge plugs and Graviner crash switches, are supplied by Rolls-Royce. The Merlin Mk 626s are basically the same as the 620s operated by Trans-Canada Air Lines on more than 2,200 Atlantic crossings, on domestic services, and on routes to Bermuda and across the Caribbean to Trinidad. Most interesting of the technical refinements is a "full-depth" intercooling system. All Merlin 620s, it may be remembered, have a two-stage supercharger with an intercooler and after-heater heat-exchanger box interposed between the supercharger and induction manifold. Hot coolant from the main cooling system is taken from the cylinder blocks and its flow through the after-heater matrix is controlled by a thermostat, set to maintain a minimum charge-temperature of 40 deg C. This measure is necessary to prevent plug-leading in cruising flight and to improve specific fuel consumption by the maintenance of a constant charge temperature under all operating conditions. At take-off, with a boost of 21.5 lb/sq in, there is no circulation in the after-heater matrix because the large amount of work being done on the air by the supercharger has raised its temperature well above the minimum of 40 deg C. Full-depth intercooling enables the after-heater matrix to be brought into the intercooler circuit to work in series with the normal intercooler matrix and thus further to reduce the charge temperature and increase the engine mass air flow. By this additional charge cooling the take-off power of 1,760 b.h.p. is maintained up to the point where the climb is eased off after take-off for ascent to cruising altitude and generally improved output is obtained.

Impending Improvement

Early aircraft of the B.O.A.C. series are fitted with an exhaust system of Canadair design, pending the introduction of the Rolls-Royce "cross-over" system. The principle of the new system, which promises a very substantial reduction in noise level, has already been proved on a York, and a Tudor II is being modified at Hucknall for further trials. Rolls-Royce have also been developing aluminium radiators for the intercooler system and the weight-saving will more than compensate the increased weight of the cross-over exhaust system.

Passenger seats, made by Vickers-Armstrongs, are of the twin adjustable type. Known as Mk 16, they weigh 60 lb apiece (less table) and embody removable centre arm and back rests, quickly detachable table mountings, non-fume ashtrays, magazine pockets, and friction-brake control for infinite variation of angle. There is a 7in clearance between the floor and the underside of the chair.



"Flight" photographs.

The upper view suggests cheery comfort, characteristic of the Canadair Four's interior. The seats are by Vickers. Also shown is the snug rear lounge.

The Marconi communication and navigational equipment is of the most modern type, fully designated as AD/107-AD/108-AD/7092. This succeeds the familiar T1154/R1155 installation of the war years. Though having four times the power of the T1154, and giving communication and D/F performances superior to those attainable with

"Flight" photograph

Registering satisfaction at London Airport are (left to right) Mr. J. W. Booth, Mr. Whitney Straight, Mr. H. Oliver West, Sir Miles Thomas, Mr. Roger Lewis, Mr. A. C. Campbell-Orde, Mr. R. A. Neale and Captain Lilly.

the R1155, the weight of the new equipment is actually 3 lb less. In addition to supplying the radio communication and radio compass equipment, the Marconi company was entrusted by B.O.A.C. with the engineering of the complete radio installation. Representatives of the company maintained the closest co-operation with Canadair, and Mr. L. A. Sweny (air manager) visited Montreal on several occasions to ensure that no detail should be overlooked. the AD107/108/7092 and associated equipment was made in the Marconi works at Chelmsford and shipped to Canada for installation.

Two Type AD/107 H.F. transmitters, two Type AD/108 medium- and high-frequency receivers, and two Type AD/7092 automatic direction finders are installed. The two transmitters provide twenty crystal-controlled spot frequencies over a range of from 2 to 18.5 megacycles and have a stability of better than plus or minus 0.02 per cent. The power output is from 100 to 150 watts (dependent on aerial characteristics). Full metering facilities permit the valve-feed currents to be checked during operation, and forced-air cooling is applied to the power amplifying valves. Miniature crystals fit directly into holders on the front panel of the drive unit. For remote single-control frequency selection and tuning, special drive motors, operated locally or by remote control, are fitted.

Although small, the Type AD/108 receivers are nine-valve superheterodynes, with facilities for the reception of C.W., M.C.W., and telephony signals. Each receiver weighs only 11 lb and has a mere 4-inch front panel width. Automatic gain control is provided and tuning is by means of a single knob. The Marconi Type AD/7092 is a complete aircraft automatic direction finder of exceptionally small size and weight. It provides automatic visual indication, aural bearings, normal "communication" reception, and radio-range reception with simultaneous voice. This receiver is fitted for full remote control.

Early this year the new equipment, fitted in a Viking, was subjected by B.O.A.C. to operational trials on the Australia and Far East routes, with satisfactory results.

The V.H.F. transmitter/receiver is of the S.T.R. 12 type, and "intercomm." is by Ultra Electric.

A Sperry Gyrosyn Compass of the new C.L.1 model is fitted, and Sperry also supply the electric gyro horizon, Type H.L.3. Smiths Aircraft Instruments, Ltd., contribute for each aircraft a Hughes periscopic sextant and hatch, a sensitive airspeed indicator, time-of-flight clock, and P.12 inverted compass. Furnishing fabrics are supplied by the Greenwich Leather Cloth Co. and Kellett Woodman, and cabin carpets are by Thomas Firth and Sons. Dunlop tyres and tubes are specified for all wheels.

Difoga's Successor

Improved Light Pusher Design from Holland

IN Holland, the pusher layout for light aircraft has for many years appealed strongly to designers. Since the war the Fokker Promotor has been the principal example, although the very first post-war aircraft to fly in that country was, in fact, a one-off prototype with a vee-eight engine known as the Diepen Difoga 421. Reference was made to both these aircraft in articles on the Netherlands aviation industry in *Flight* of October 28th and November 18th, 1948.

The three men responsible for the Difoga were Mr. H. Koekebakker, Ing. J. Weyer and Mr. Frits Diepen. The first-named has more recently continued his studies with a view to producing an inexpensive light touring and training machine. He has called his design the 471 and has adopted a high-wing, single tail pusher layout with two seats side by side.

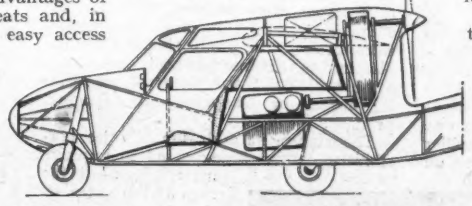
By comparison with the earlier Difoga layout the advantages are low mounting of the engine, the elimination of two tail-booms which might be both expensive and rather heavy, and the use of a somewhat simpler and cheaper strut-braced high wing. The new design retains the advantages of excellent view forward from both seats and, in addition, offers good rearward view, easy access and reduced noise and vibration levels. Widely spaced nose and main wheels—a feature of the earlier Difoga making for good stability on the ground—have been retained.

For the airscrew drive it is proposed to use a latex-hevaloid belt of a type used extensively in industrial machinery, where heavy loads are transmitted satisfactorily for many thousands of hours. The designer is aware of the unorthodox nature of this proposal and, although he has the fullest confidence in it, is prepared to substitute a bevel-gear drive if the belt does not come up to expectations under full-scale test both in the air and on the ground.

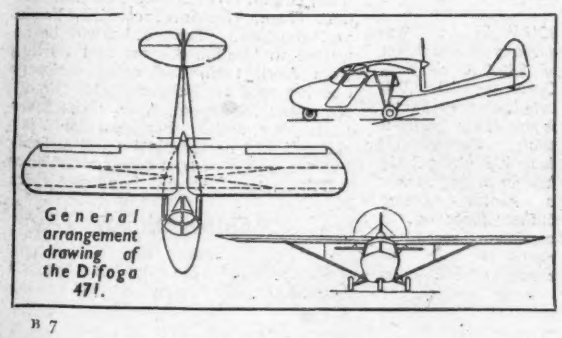
The main features of the Difoga 471 are shown in this photograph of a model.

Any type of power unit with an output of between 65 and 100 h.p. could be installed in the Difoga, and between the engine compartment and the rear seats, approximately on the centre of gravity, would be a sizeable luggage space.

A somewhat unusual feature intended to reduce the cost and difficulties associated with building and testing is that the prototype design specifies the use of several existing Piper Cub components, namely, wings and struts, landing gear, tail unit and, if necessary, the Continental 65 h.p. engine. The designer's headquarters are at Koevoetstraat 39, Bergen-op-Zoom, Holland.



Diagrammatic sketch of the engine and airscrew drive.



General arrangement drawing of the Difoga 471.

A.T.A. REUNION

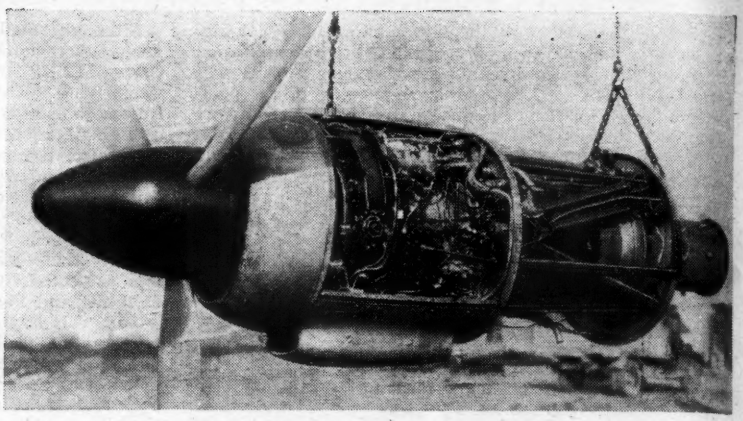
THE A.T.A. Association is to hold its annual general meeting and spring reunion at the West London Aero Club on April 9th, beginning at p.m. Tickets (2s—W.L.A.C. members free) are obtainable from the A.T.A.A. hon. secretary at 31, : Onslow Gardens, London, N.10, or at the door. Arrangements have been made for a motor coach to meet the 4 p.m. train from Paddington to Maidenhead.

ROTAX IN CANADA

ROTAX, LTD., announce the formation of Rotax, Canada, Ltd., at Montreal Airport. The new company will embrace all the interests of Rotax, Ltd., and Joseph Lucas (Gas Turbine Equipment), Ltd., in Canada, and activities will initially be limited to engineering and commercial liaison, servicing of electrical and gas-turbine equipment and the stocking of spare parts.

Directors of the new company are Messrs. E. J. Earnshaw (president), J. Hulbert, F. P. Turville and E. B. Fairbanks. The vice-president is Mr. Hulbert, who was formerly a senior Rotax liaison engineer in England.

HERE AND THERE



THE WAY OF A SERPENT: An Armstrong Siddeley Mamba power unit, complete with its de Havilland airscrew, as it appeared when ready for installation in the first Armstrong Whitworth Apollo. The Apollo is the world's first airliner with axial-flow turboprops.

High Gliding

A NEW Swiss gliding record for height above starting-point in a two-seat sailplane is claimed by Hans Nietlispach. At Berne, on April 1st, in a Kranich, he reached a height of 10,830ft. The previous record, of 9,807ft, was held by Alwin Kuhn and Max Ritter.

American Aid

THE transference of American piston-engined aircraft to Western European nations, under the terms of the North Atlantic pact, was discussed by the *New York Times* on April 3rd. It stated that applications for some of the thousands of stored U.S.A.F. aircraft had already been received from Powers signing the pact. British preference was for between 150 and 200 Superfortresses.

Cadets in Brussels

A DETACHMENT of some 40 members of the Surrey Cadet Corps, complete with drum and bugle band, flew in a chartered Sabena Skymaster to pay a goodwill visit to Brussels. After an inspection by Brig. D. A. L. Mackenzie, C.B.E., D.S.O., the party left London Airport on Friday, April 1st and was due to return on April 4th. In Brussels the cadets laid a wreath on the tomb of the Belgian Unknown Soldier's Memorial, and marched past the Minister of Defence.

Aeronautical Studentship

THE trustees of the Busk Studentship in Aeronautics, which was established in memory of Edward Busk, a pioneer pilot killed in 1914, announce a vacancy for this year. Valued at about £165, the studentship is tenable for one year from October 1st, which the holder must devote to aeronautical research on a subject approved by the Trustees, following which he may be re-appointed for a second year on the same terms. Applicants, who must be British men or women under 25, may obtain forms from the Professor of Aeronautical Engineering, Engineering Laboratory, Cambridge.

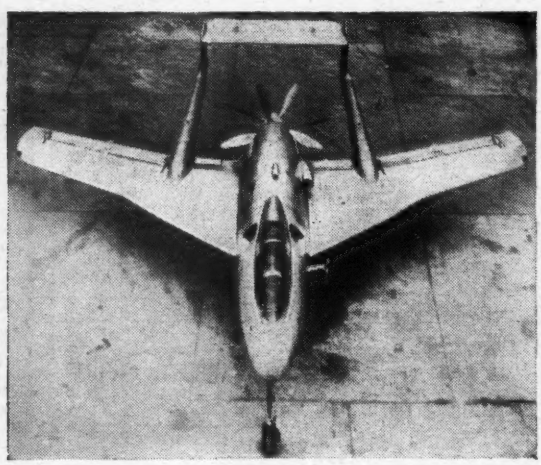
More Mapping

THE Canadian Government has announced that it will spend £310,000 on air survey during the forthcoming financial year. Some 250,000 square miles will be photographed, of which the R.C.A.F. will cover 200,000 square miles and civil operators the remainder. During last season, the R.C.A.F. mapped a total area of 911,000 square miles from the air.

U.S. Company's Losses

THE annual report of the Glenn L. Martin Company shows that during last year the firm suffered a net loss of $16,710,762. Profits from military sales, it is stated, were offset by losses in the commercial field. Pending firm orders from airlines, the production line for the Martin 2-0-2 airliner has been shut down, although it has "ably demonstrated that it meets or surpasses its original promise."

The statement adds that "sales possibilities cannot be expected to improve materially until the cash and credit position of the domestic airlines, and the dollar exchange availabilities of interested foreign lines are greatly bettered."



SOU'WESTER: Produced by the French firm of S.N.C.A. de Sud-Ouest, the SO 8,000 twin-boom naval fighter is now ready for flight trials. The modified Jumo 213, giving 2,250 h.p. for take-off, drives a contra-rotating pusher propeller. A maximum speed of nearly 460 m.p.h. and a range of 2,800 miles are expected.

Coalition

PARTY differences were forgotten by a number of ex-R.A.F. Members of Parliament last week, at a dinner inaugurating the Members' branch of the R.A.F. Association—the 700th branch to be formed. Air Marshal Sir Robert Saundby, chairman of the R.A.F.A. Council, and G/C. Vaughan, chairman of the Association's national executive committee, were also present. Among the first branch officials appointed were W/C. E. Shackleton (Preston), chairman, and A. Cdre. A. V. Harvey (Macclesfield), vice-chairman.

Fuel Expert Retires

WITH the retirement last week of Mr. George N. Wilson from the Board of Shell-Mex and B.P., Ltd., the petroleum and aviation industries lose a leading personality. At about the time when Mr. Wilson was appointed assistant general manager, Shell-Mex acquired their aircraft, and in 1931 he flew a D.H. Moth in the King's Cup Race. For some years before the war until its end in 1945 he advised the Air Ministry on fuel storage and distribution, and from 1939 to 1945 held the post of Aviation Co-ordinator of the Petroleum Board.

Airfield Sightseeing

PUBLIC enclosures at civil airfields have in recent years done much to increase national interest in air affairs, especially when combined with an informative loudspeaker system. With the advent of better weather, a number of M.C.A. enclosures all over the country are being opened.

Among those now open are Birmingham, Bristol (Whitchurch), Cardiff, Croydon, Hurn, Weston, Prestwick, Yeadon and Renfrew. The public will be admitted to London Airport and Northolt from April 13th, and other enclosures opening soon are Belfast (Nutts Corner), May 7th; Blackpool, April 14th; Liverpool, May 26th. Facilities for "joy-riding" will be arranged at all airfields, but are restricted by traffic congestion at Northolt, Croydon and London Airport.

Elstree Display

AIRCRAFT from the R.A.F. and U.S.A.F. will take part in the United Services Flying Club Air Display,

HERE AND THERE

which is to be held at Elstree on Easter Monday, April 18th. There will also be bombing and parachute-dropping demonstrations. Proceeds will go to the Soldiers,' Sailors' and Airmen's Families Association; the price of admission will be 2s 6d, with half-price for children.

"Flight" Index

THE index to Vol. LIV (July-December, 1948) of *Flight* is now available. Copies may be obtained (at 1s 1½d, or 5s 4d with binding case, postage included) from Flight Publishing Co., Ltd., Dorset House, Stamford St., London, S.E.1.

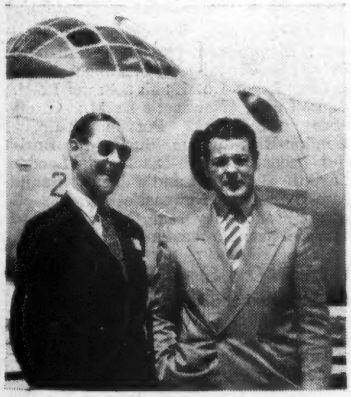
Air-Philately

THE late Sir Lindsay Everard's collection of air-mail stamps is to be disposed of by Francis J. Field, Ltd., the air stamp experts of Sutton Coldfield. Occupying 70 volumes, the collection included almost every stamp prepared for aerial postage, whether or not its issue was developed.

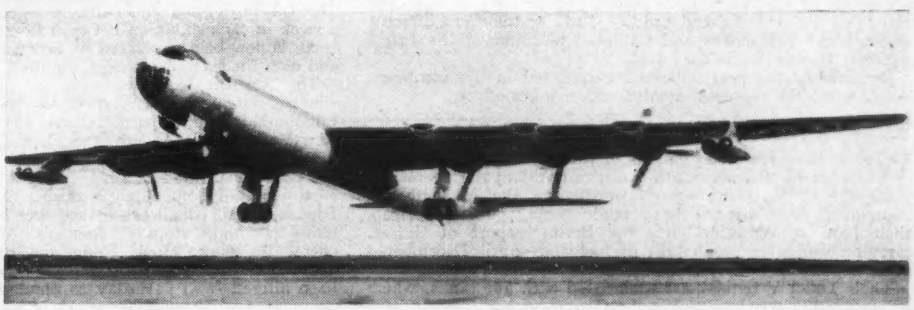
Wolverhampton Air Race

IT is hoped that between 50 and 60 pilots will compete in the 1949 Goodyear Trophy open handicap, which is to be held at Wolverhampton on Saturday, May 28th, in conjunction with the Wolverhampton Aero Club's display. Cash prizes totalling £190 will be awarded, the winner receiving £100 and a replica of the trophy.

All flying clubs will receive details of the race, which is sponsored by the Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd.; non-club-members should apply to the Wolverhampton Aero Club, The Airport, Wolverhampton. The race is open to professional and amateur pilots flying any civil-registered piston-engined aircraft, and will comprise three left-handed circuits, each of approximately 21 miles.



AT FORT WORTH: Mr. "Bill" Pegg, chief Bristol test pilot, has recently been flying the B-36 bomber at the Convair Corporation's Texas plant. He is seen above with Mr. Gus Green, flight manager (right). All B-36s will acquire the additional power of four J-47 turbojets, mounted in underslung wing-tip "pods," as shown on the right.



FEARFUL FULFILMENT: By continuous repetition of this hazardous-looking operation, Bill Harris (at controls) and Dick Riedel hope to keep their Aeronca Sedan airborne for 1,000 hours. An earlier attempt by the two pilots to beat the 27-day endurance record was cut short by a crash landing last November.

N.Z. Air Pageant

FORMATION aerobatics by three Harvards of the R.N.Z.A.F. were a highlight of a display organized by the Royal New Zealand Aero Club at Mangere, Auckland, on March 20th. A rope of 50 lb breaking strain, which linked the Harvards throughout their performance, remained unbroken when they landed. An Olympia sailplane was also demonstrated, and there was single-engined formation flying by Dakotas.

French Record

THE world's duration record for a single-seat glider returning to its take-off point was captured by a French pilot, M. Guy Marchand, of the Aéro-Club Vauclusien, on March 16th-18th. M. Marchand was airborne for 40 hr 55 sec in a Nord 2,000, which is a French version of the German Meise high-performance sailplane. Germany held the previous record for over 15 years, with a 36½-hour flight by Kurt Schmidt in a Grunau Baby on August 3rd-4th, 1933.

News in Brief

LODGE PLUGS, LTD., announces the appointment of Mr. F. M. Sayers, O.B.E., as general manager.

* * *

The Northrop XF-89 Scorpion two-seat, twin-jet all-weather fighter, which is being tested by the U.S.A.F. at the Muroc experimental base, is reported to have a maximum speed of over 625 m.p.h.

* * *

Three Hawker Tempests were recently flown by Airwork pilots from Blackbushe Airport to Cawnpore. The journey took 6½ days; the actual flying time was approximately 20 hours, bad weather grounding the aircraft for a time at Nicosia and Baghdad. No servicing was carried out *en route*.

* * *

Replying to a recent criticism that the giant B-36 bomber can operate from only three bases in the United States, the U.S.A.F. has disclosed that, fully loaded, the aircraft can work from 41 American airfields. At a lightened, end-of mission, weight of 200,000lb it can land at 285 more U.S. bases.

TWENTY YEARS AGO, on March 30th, 1929, a Short Calcutta flying boat flew the Mediterranean section of the first service from the U.K. to India, operated by Imperial Airways. The journey, which took seven days, had to be made partly by train as flying rights through Italy were not held.

CIVIL AVIATION NEWS

B.O.A.C. to Buy Sweden's Stratocruisers? Ferrying Berlin's Fuel: Charter Firms' Scheduled Services

STRATOCRUISERS FOR STERLING

SWEDISH AIRLINES, part of the Scandinavian Airlines System, has offered to sell for sterling four Boeing Stratocruisers and, as the six Stratocruisers on order for B.O.A.C. are many months behind schedule—it is reported that they will probably not be delivered until November—it is likely that the Corporation will accept the Swedish offer. S.A.S. recently decided to standardize its long-range services and use Douglas Skymasters.

This is the second time B.O.A.C. has been able to buy American aircraft without spending dollars, as the decision of Irish Airlines to drop its proposed transatlantic service released five Constellations which the Corporation was able to buy for sterling.

If the proposed purchase is allowed, by the end of this year B.O.A.C. may have a fleet of 11 Constellations, ten Stratocruisers, 22 Canadair Fours (the first of which, as reported in this issue, arrived at London Airport on March 29th, two months ahead of schedule) and 25 Hermes IV aircraft at present on order from Handley Page's, for use on Empire routes.

B.S.A.A. DEPUTY CHAIRMAN

THE Minister of Civil Aviation has appointed Sir Francis Brake M.I.E.E., as deputy chairman of British South American Airways Corporation, with effect from April 1st. He succeeds Sir John Stephenson, C.B.E., who recently resigned from the post, but who will take (without remuneration) the place on the Board vacated by Sir Francis Brake.

During the war Sir Francis Brake was Controller of Construction and Regional Services at the Ministry of Aircraft Production, and was concerned with the dispersal of factories; he was a member of the Air Supply Board. Since 1933 he has been managing director of Creed and Co., Ltd., and is also a director of Standard Telephones and Cables, Ltd., and of the International Marine Radio Co., Ltd.

Presumably the post will be incorporated in the combined Board when the proposed amalgamation takes effect.

REFUELLING BERLIN

WELL over 1,000,000 gallons of fuel have been flown into Berlin by British South American Airways Corporation. Since the Corporation began operating on the Air Lift last September their aircraft have made some 700 sorties from their base at Wunsdorf into the Berlin airport of Gatow, carrying well over 5,000 tons of fuel and—until December—other supplies as well.

Their Tudor V tankers are each fitted with five tanks, which carry on each trip a total of 2,300 gallons of petrol or 2,100 gallons of fuel oil. A recent addition brings the fleet up to five, and each aircraft makes from three up to as many as six sorties in a day. The aircraft are operated by twelve crews who normally do a twelve-hour spell of duty, followed by 24 hours off.

AIR FRANCE TO BELFAST

ON June 13th Air France is to start a service between Belfast and Paris—the first service linking Northern Ireland and the French capital. Operating three times a week, on Mondays, Wednesdays and Saturdays, the service will be an extension of the direct Glasgow-Paris route which has been operated since 1946. The 33-seater Languedoc aircraft will take 4½ hours, stopping for a short time at Prestwick, and reaching Paris before midday, in time to connect with services to the French Riviera, Switzerland, Corsica, New York and Cairo.

By stopping overnight in Paris, connections can be made with Rome, North and West Africa, South America, India and the Far East. The return fare on the Belfast-Paris service will be £26 11s. Offices are being opened at Nutts Corner Airport for reservations and enquiries.

CHARTER FIRMS' SCHEDULED SERVICES

SINCE the Minister of Civil Aviation announced that charter companies would be permitted to operate scheduled services as associates of the Corporations (*Flight*, February 3rd), negotiations covering thirty routes have been completed. In answer to a question in the House of Commons, Mr. Lindgren, Parliamentary Secretary to the Ministry of Civil Aviation, said that although no formal agreements had been completed, provisional approval had been given to charter companies operating under associate agreements with B.E.A. on the following routes:—

Scheduled services at ordinary fares: Blackpool-Southport; Birmingham-Southampton; Birmingham-Jersey; Cardiff-Jersey and Guernsey; Leeds-Jersey; Blackpool-Jersey; Manchester-Jersey; Birmingham-Isle of Man; Leeds-I.o.M.; Manchester-I.o.M.; Blackpool-I.o.M.; Glasgow-I.o.M; Newcastle-I.o.M.; Cardiff-Barnstaple; Croydon-Isle of Wight; Portsmouth-I.o.W.; Southampton-I.o.W.; London-Birmingham (during the British Industries Fair); London-Leeds; London-Blackpool; London-Manchester; London-Cardiff; London-Land's End; Cardiff-Birmingham; Birmingham-Blackpool; Newcastle-Belfast.

Inclusive tours: Southampton-Jersey and Guernsey; Aberdeen-Belfast; Birmingham-Belfast; Newcastle-Jersey.

CHANGES IN B.O.A.C. SERVICES

ON April 1st B.O.A.C. increased the frequency of its London-Montreal service to two flights a week in each direction; Constellations now leave London Airport on Tuesdays and Fridays. Three return services a week now fly between London and New York; on Mondays and Saturdays a stop is made at Prestwick, and on Wednesdays the service flies via Shannon. The Liberator mail and cargo service, which flies three times a week in each direction between London, Prestwick and Montreal, is now being operated by Scottish Airlines, who maintain and man the six Liberators in the fleet.

The Atlantic excursion rate, in operation throughout the winter, was withdrawn on March 31st and fares are now: London-Montreal, £150 1s return, £83 7s single; and London-New York, £156 7s return, £86 17s single.

On the Plymouth flying-boat service to Japan, Shanghai has been substituted as a night stop in place of Iwakuni, where a stop of only one hour is made. The weekly service from Southampton, which takes just over a week to fly the 10,000 miles has night stops at Augusta, Alexandria, Karachi, Calcutta, Bangkok, Hong Kong and Shanghai. The day of departure from Tokyo on the west-bound flight has recently been altered from Saturday to Sunday.

British Airways' Operating Statistics for December, 1948

	B.E.A. All Divisions	B.E.A. British Division	B.E.A. Continental Division	B.O.A.C. All Divisions	B.O.A.C. Western Division	B.O.A.C. Eastern Division	B.S.A.A. Division
Passengers carried	29,630 (26,950)	17,594 (16,863)	12,036 (10,087)	9,720 (8,325)	2,153 (2,056)	7,567 (6,269)	2,473 (1,307)
Cargo carried :							
Mail (tons)	360.2 (173.2)	136.8 (109.2)	223.4 (64.0)	190.8 (197.1)	43.2 (39.7)	147.6 (157.4)	22.6 (16.9)
Freight (tons)	440.0 (285.4)	108.3 (69.9)	331.7 (215.5)	309.1 (189.8)	52.0 (40.1)	257.1 (149.7)	68.5 (58.0)
Average load :							
Passengers (No.)	11.1 (10.8)	9.3 (7.1)	12.3 (14.4)	14.7 (11.5)	24.9 (20.3)	13.7 (10.2)	10.9 (11.0)
Total (lb)	2,819 (2,519)	1,982 (1,429)	3,249 (3,426)	4,839 (3,876)	5,830 (6,468)	4,698 (3,527)	4,477 (4,459)
Average capacity :							
Seats (No.)	18.8 (16.8)	16.1 (13.3)	20.5 (20.2)	23.4 (19.2)	41.6 (42.7)	21.7 (15.8)	24.0 (21.7)
Total (lb)	4,515 (3,997)	3,281 (3,011)	5,149 (4,817)	7,656 (6,204)	9,392 (11,392)	7,409 (5,505)	8,221 (7,380)
Average Length of Haul :							
Passenger (Miles)	312 (298)	172 (156)	505 (527)	3,118 (3,061)	2,342 (2,698)	3,305 (3,182)	2,134 (3,677)
Mail (Miles)	467 (369)	169 (139)	649 (763)	4,746 (4,243)	3,526 (3,468)	5,104 (4,438)	5,248 (5,419)
Freight (Miles)	492 (576)	198 (162)	588 (710)	3,521 (3,589)	3,094 (3,259)	3,608 (3,678)	4,446 (6,188)
Hours flown :							
Revenue : Passenger services	5,715 (5,262)	2,749 (3,023)	2,966 (2,239)	10,414 (11,101)	718 (1,159)	9,696 (9,942)	2,260 (2,094)
Cargo services	651 (428)	— —	651 (428)	1,114 (473)	525 —	589 (473)	— (108)
Charter and special flights	89 (50)	78 (50)	11 —	425 (444)	16 —	409 (444)	193 —
Non-revenue	224 (206)	99 (103)	125 (103)	870 (2,011)	299 (750)	571 (1,261)	335 (143)
Equivalent annual utilization (revenue hours flown) per aircraft	1,015 (955)	906 (915)	1,125 (1,007)	1,158 (1,386)	— —	— —	1,169 (1,515)
Unduplicated route miles in operation at end of period	12,692 (13,290)	2,265 (3,789)	10,427 (9,501)	67,221 (55,175)	8,523 (7,748)	58,698 (47,427)	24,194 (23,168)
Percentage regularity	92.3 (94.0)	95.6 (96.2)	85.1 (86.5)	98.7 (97.1)	93.0 (100.0)	99.5 (96.9)	99.2 (98.3)
Average length of stage flights (miles)	197 (178)	107 (112)	417 (425)	1,035 (908)	1,124 (1,227)	1,023 (877)	922 (1,241)

CORPORATIONS' TRAFFIC

OPERATING statistics for the three British airways corporations during 1948, to which brief reference was made last week, are given in the adjacent table. In the larger table, above, are the detailed figures for the month of December; they show that although B.O.A.C. and B.S.A.A. carried fewer passengers than in November, B.E.A. carried 29,630 passengers compared with 22,662 in November, and 26,950 in December, 1947. B.E.A.'s freight and mail figures for December show great increases over those for November and for December, 1947. Figures for December, 1947, are given in parentheses.

Statistics for the Year

	B.E.A.	B.O.A.C.	B.S.A.A.	Total
Aircraft miles flown				
1948	12,348,184	26,350,943	5,350,096	44,049,223
1947	11,539,058	23 009,588	4,453,277	39,001,923
Percentage increase	7.0	14.5	20.1	12.9
Passenger-miles flown				
1948	150,725,470	352,028,671	52,607,923	555,362,064
1947	108,322,695	283,643,782	47,185,700	439,152,177
Percentage increase	39.1	24.1	11.5	26.5
Mail ton-miles flown				
1948	949,163	7,904,080	1,092,370	9,945,613
1947	544,306	6,772.291	915,768	8,232,365
Percentage increase	74.4	16.7	19.3	20.8
Freight ton-miles flown				
1948	2,176,192	10,429,250	3,025,839	15,631,281
1947	1,320,071	6,124,717	2,741,570	10,186,358
Percentage increase	64.9	70.3	10.4	53.5

M.C.A. INFORMATION CIRCULARS

WITH the resumption of publication of *The Air Pilot*, reported recently in these columns, certain *Notices to Airmen* have been re-numbered as M.C.A. Information Circulars and (says the Ministry) should be retained for future reference. All other *Notices* of the years 1945-1948/9 have either been incorporated in the *Air Pilot* or have become obsolete, and are to be regarded as cancelled.

The Information Circulars will be distributed to operating companies, flying clubs and aircraft owners, and also to individuals who completed the application in *Notice to Airmen* No. 105/48.

AIR-INDIA AFFAIRS

AIR-INDIA announce an increase in the frequency of their Bombay-Calcutta service, additional aircraft on Tuesdays and Sundays leaving Bombay at 1200 hr and arriving at Calcutta at 1720 hr. In the reverse direction there are extra services on Mondays and Wednesdays, leaving at 1300 hr and arriving at 0730.

The Company's general manager, Mr. B. W. Figgins, is returning to this country early this month to take up a London appointment. Mr. K. J. Bhore, who has been assistant manager for just over three years, has been appointed general manager of Air-India, Ltd., and Air-India International, Ltd.

BREVITIES

INSTRUCTION for ex-R.A.F. personnel wishing to obtain commercial and other licences is being offered by the Cheltenham Aero Club at Staverton Airfield. Details are given in "From the Clubs" overleaf.

* * *

Pan American Airways' 61-seater Stratocruisers went into operation on a new San Francisco-Hawaii service on April 1st. The service operates three times a week and the flight takes 8½ hours. This is in addition to the regular service to Hawaii, the South Pacific and the Orient.

* * *

Part One (Transmission Schedules and Station Index Numbers) of the *Handbook of Weather Messages, Codes and Specifications* published by the Meteorological Office includes full details (frequencies, wavelengths, transmitting stations and contents) of weather messages issued by wireless telegraphy and radio-telephony in Great Britain, Gibraltar, Malta, Egypt and the British Occupied Zone of Germany.

Details are also given of the international index numbers of stations reporting, of territorial, national, sub-Continental and Continental technical broadcasts for which the U.K. is re-

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sponsible under international agreement, and of telephony broadcasts, including B.B.C. transmissions, the "Airmet" broadcast and G.P.O. Coastal Broadcasts. This publication is obtainable from His Majesty's Stationery Office, price 2s 6d.

* * *

In an effort to comply with shippers' requirements B.O.A.C. introduced a new scheme on April 1st whereby invoices are issued with the consignor's copy of the consignment note and both documents are issued on receipt of goods and not necessarily after despatch. A Certificate of Shipment is issued on the departure of the goods. Further information is available from the Freight Enquiries Section, Airways Terminal, London, S.W. 1 (Victoria 2323).

* * *

The Ministry of Civil Aviation announces (*Notice to Airmen No.* 506) that in order to give aircraft commanders a more accurate mental picture of their position in relation to the extended centre-line of the runway, the following additional R/T phrases have been introduced and may be used by the G.C.A. final controllers:

"Your heading of . . is good. You are closing towards the centre-line from the left/right."

"Your heading is good. You are on the centre-line."

"Turn left, left/right 3 degrees. You are slightly left/right of the centre-line."

The chairmanship of the board of Cyprus Airways, Ltd., the line which was formed some 18 months ago by local interests, the Cyprus Government and British European Airways, is to be filled by Commander V. Wolfson, O.B.E., V.R.D. He has represented B.E.A. on the board of Cyprus Airways since the inception of that company; he is also deputy chairman of International Aeradio, Ltd., and a director of Alitalia and Gibraltar Airways.

* * *

Reductions in fares on Aer Lingus routes, and the introduction of cheap excursion fares, have recently been announced. Thirty-day excursion fares of £11 from Dublin to London, £9 to Birmingham, £7 to Glasgow, £6 6s to Liverpool and £6 12s to Manchester will bring the rates to almost pre-war level. Reductions of between 9 and 22 per cent have been made on the ordinary six-month return fares on six of the company's routes. On April 4th Dublin became a regular stopping place on the London-Shannon route.

* * *

In the three years since March, 1946, American Airlines claim to have flown 4,153,637,050 passenger-miles without a fatal passenger accident. Since the inauguration of the transatlantic service in June, 1942, American Overseas Airlines has made more than 18,000 crossings, carrying 191,558 passengers to and from New York and flying 57,410,059 miles. Both American Airlines and American Overseas Airlines (which latter company operated at a profit of £250,000 during 1948), hold the U.S. National Safety Council's awards for safe air transportation.

FROM THE CLUBS

MEMBERS of the Orkney Flying Club recently visited St. Margaret's Hope, where they inspected the private aircraft being constructed by Mr. Petrie. On the occasion of the visit of H.M.S. *Whirlwind* to Scapa Flow, three members were entertained aboard by Vice-Admiral Sir Ernest Arch.

Ground training facilities, which will be available to the general public, are being arranged in conjunction with the County education authorities.

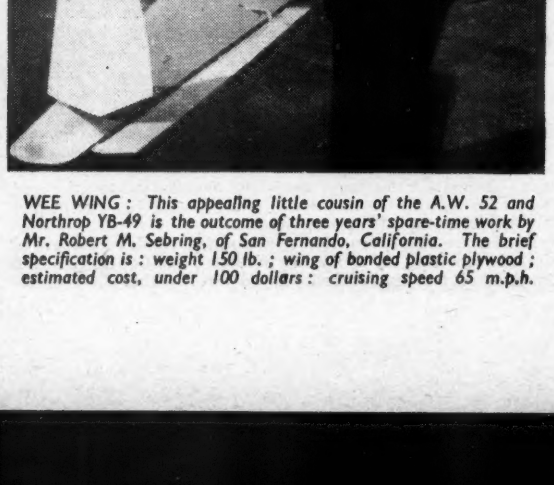
Application has been made for Associate Membership of the A.B.A.C. and serious consideration is being given to the purchase of an Auster, in addition to the one placed at the disposal of the Club by Mr. Bichan. It is hoped that club flying will be possible between Longhope, Hoy and the Orkney mainland and representations have been made for the provision of refuelling facilities at Wick Airport.

* * *

THE Cheltenham Aero Club, operating at Staverton Airfield, Cheltenham, was founded with the object of providing instruction for ex-R A.F. personnel wishing to secure Commercial Licences, Instructors' Certificates, Instrument Rating, Navigators' Licences and Engineers' Licences. On the staff are fully qualified instructors in licence requirements, while six of the committee members are qualified flying instructors.

Normal club instruction and flying is available at £2 per hour, but much of the flying for the commercial-pilot and navigator courses can be done at £1 per hour. The lack of suitable premises is at present proving a handicap, and until improvements are made only a very limited number of pupils can be accepted for the advanced courses. One course now in progress is for assistant instructors who want full Instructors' Certificates; new pilot and navigator courses are starting this month.

Ab initio courses for pilots or navigators can commence at any time to suit the individual pupil and residence can be arranged at a reasonable cost.



WEE WING: This appealing little cousin of the A.W. 52 and Northrop YB-49 is the outcome of three years' spare-time work by Mr. Robert M. Sebring, of San Fernando, California. The brief specification is: weight 150 lb.; wing of bonded plastic plywood; estimated cost, under 100 dollars: cruising speed 65 m.p.h.

* * *

MEMBERS of the Leicestershire Aero Club held a very successful dinner dance on March 19th to mark the end of the winter season. The last of the series of monthly socials, the event was attended by more than 100 members and their friends.

Like every other club in this country, the Leicestershire Aero Club has been affected by the high cost of flying; nevertheless, considerable enthusiasm has been maintained, and during the financial year which ended on March 31st 14 new "A" licences were obtained by members. Arrangements for the Annual Air Rally have now been completed, and it is announced that the event will take place on Sunday, May 29th at Ratcliffe Aerodrome.

Members suffered a great loss by the death of Sir W. Lindsay Everard, who had been President for many years and who had done so much to help the Club.

* * *

ONE bright spot in the rather sombre club outlook is provided by the news that the Nottingham Flying Club have reduced their flying charges and membership fees. On the three-seater Auster the block hourly rate (minimum of ten hours) is £2 5s and the normal hourly rates £2 10s (Mondays to Fridays) and £3 (week-end). On the Auster J.4 the block rate is £2 and the normal rates £2 5s and (week-end) £2 10s.

In order to encourage younger members the entrance fee for those under 25 years of age has been reduced to £1 1s and the annual subscription to £2 2s. The Club hopes that the changes will meet with spontaneous approval, as they hazard a serious financial loss; during 1948 a deficit of £400 was shown.

The annual dinner dance was held on March 3rd at the George Hotel, Nottingham, with the Lord and Lady Mayoress and G/C. and Mrs. Donaldson as the guests of honour. The Journal Cup was presented to Mr. B. Dowson and the Shipstone Trophy to Mr. J. Dolby. On March 18th the chairman, Mr. T. W. Shipside, and Mr. P. B. Cash, the C.F.I., flew to Ireland in the Club Gemini to visit Shannon Aero Club, whose chairman, Mr. Topping, made his first solo flight at the age of 62.

EMPIRE-BUILDERS

Ministry of Civil Aviation to Cost More Than £22½ Million

THE Civil Estimates for 1949-50, issued last week, reveal that although the cost of the Ministry of Civil Aviation is expected to show a decrease of nearly £3¾ million, the taxpayer will have to find more than £22½ million for the Department. The main subheads under which this large sum is to be spent are tabulated below, but a more detailed examination of some of them is rewarding.

Beginning at the top—of the Ministry as well as of the table—one finds that a real effort has been made to economize in the matter of personnel. The total number to be employed will fall from 8,588 last year to 8,550! In the Ministry itself, headquarters staff is being reduced from 1,786 to 1,720. It is hoped that these drastic reductions will not seriously affect the efficiency of the Ministry.

A close examination of subhead A reveals that savings have been effected at headquarters by doing without the following: one Controller of Technical and Operational Services; one Controller of Aerodromes; six Assistant Directors; one Temporary Administrative Officer II; 20 Staff Pilots; ten Staff Navigators; 62 Assistant Signals Officers; two Aerodrome Advisors; and one Supervising Draughtsman. At outstations they will have to get along without: One Commandant (Fire School); 43 Assistant Signals Officers; and two Temporary Assistants.

It seems a little odd that it should take a total of 8,550 people, most of them on the ground, to keep three (shortly two) Corporations operating at a heavy loss in the air.

"Clerical, typing, etc., staffs" appear to account for some very large sums. At headquarters there are 805 of them, and their salaries amount to £239,573. At outstations the number is 789 and the salaries £218,110.

Senior Salaries

Further delving into the details of headquarters staff reveals that there are six Under-Secretaries drawing £2,000 each; 16 Assistant Secretaries who between them cost £23,652; six Directors absorb £9,155 and 12 Deputy Directors £16,045.

The number of representatives overseas has been doubled and they seem to be fairly well paid, as 14 of them account for £33,308.

Looking down the table, it is interesting to find that, in subhead E, a sum of £253,000 has been set aside to defray the expense of aircraft employed on departmental duties. At first one assumes that this expense must be an operational one, as purchase of official communications aircraft does not figure in these estimates. (Last year that item accounted for £436,000.) But under subhead L the operation and maintenance of official communications aircraft require £135,000.

There is a very large drop in subhead F, payments for research, development and production. Last year this accounted for £10,314,000, whereas this year's figure is £4,636,500. Presumably the bulk of this sum is in the form of progress payments and so forth in connection with the Brabazon and the Princess flying boats.

Subhead G accounts for very large sums, although those to be voted for 1949-50 are, generally speaking, but a fraction of the total estimated costs of the work. During this next financial year, airports are expected to require the following amounts: Belfast (Nutts Corner), £40,000; Blackbushe, £2,500; Bovingdon, £124,000; Croydon, £33,000; Edinburgh (Turnhouse), £16,000; Hurn £35,000; Kirkwall (Hatston), £47,000; Liverpool (Speke), £7,000; London Airport, £3,205,000; Manchester (Ringway), £104,000; Northolt, £115,000; Prestwick, £113,000; Renfrew, £208,000; Scilly Isles, £8,500; Southampton Water Marine Base, £5,000; Stansted, £30,000; Stornoway, £7,000. To these must be added £1,500,000 for purchase of lands and buildings, and other items which bring the total expenditure under this subhead up to £7,772,000.

Grants to meet any excess of expenditure over revenue for the three Corporations are: B.O.A.C., £3,500,000; B.E.A.C., £1,700,000; B.S.A.A.C., £250,000; associates of the three Corporations, £10,000.

In subhead L there appears a sum of £100,000 for the Air Registration Board. This independent body is doing excellent work on airworthiness and in other directions, and in addition to its other problems it has had to struggle with financial difficulties. It is to be hoped that the latter will be somewhat reduced by this grant.

	1949-50	1948-49	Increase	Decrease
	£	£	£	£
A.—Salaries, etc.	3,563,084	3,757,583	—	194,499
B.—Travelling and Incidental expenses	200,000	200,000	—	—
C.—Air Transport Advisory Council	3,500	10,000	—	6,500
D.—Non-technical supplies and Transportation ...	385,000	322,000	63,000	—
E.—Equipment, stores and ancillary services	1,678,000	2,389,000	—	711,000
F.—Civil Aircraft and associated equipment	4,636,500	10,314,000	—	5,677,500
G.—Works, buildings and lands	7,772,000	4,892,000	2,880,000	—
H.—Ground services for Commonwealth and other routes: grants and other expenses	2,000,000	2,700,000	—	700,000
J.—Meteorological services ...	299,500	418,300	—	118,800
K.1.—Grants to British Overseas Airways Corporation...	3,500,000	5,250,000	—	1,750,000
K.2.—Grants to British European Airways Corporation	1,700,000	2,000,000	—	300,000
K.3.—Grants to British South American Airways Corporation	250,000	400,000	—	150,000
K.4.—Grants to associates of the three Corporations ...	100,000	50,000	50,000	—
L.—Various aviation services: grants and other expenses	321,800	295,400	26,400	—
M.—Catering services ...	61,000	73,000	—	12,000
N.—Miscellaneous expenses	242,000	207,000	35,000	—
Gross total ... ...£	26,712,384	33,278,283	3,054,400	9,620,299
Deduct:				
Z.—Appropriations in aid ...	4,158,300	6,963,500	2,805,200	—
Net total ... ...£	22,554,084	26,314,783	5,859,600	9,620,299
Net decrease ... ...£			3,760,699	

The cost of the items listed in the subheads is reduced by appropriations in aid, which are expected to total £4,158,300. Sale and lease of aircraft are expected to bring in £2,203,700; rents another £600,000; and housing and landing fees £650,000.

A.I.D. PARTY AT CHRISTCHURCH

ALTHOUGH organized by the area Aircraft Inspection Department, the recent dinner and dance at Christchurch was, in effect, a pleasant and useful opportunity for Hampshire and Isle of Wight aviation personalities to get together. Airspeed and Saunders-Roe visitors, of course, predominated, but people arrived for this relatively informal little party from the most surprising places.

With Mr. E. W. Jolliffe (Principal Inspection Officer of the South-Western Area A.I.D.) in the chair, the speakers included Mr. A. Townsley, a director of Airspeed, and Mr. Robert Perfect, of Saunders-Roe. Both were amusing and pointed as usual, replying for the visitors and proposing the toast of the A.I.D. respectively. The Royal Air Force was represented by W/C. Gutteridge.

Speakers' subjects ranged from the Air Lift to the recent air-refuelled flight by the U.S.A.F. Boeing B-50; the latter subject was particularly appropriate in view of the presence of Sir Alan Cobham.

FATIGUE

An Examination of the Types and Effects of Fatigue in Aircraft Structures

"AT the present time there are indications that structural fatigue may become a major factor in design, at least for some types of aircraft. If this be so, the prospect is disturbing to the aircraft designer." With these words, Mr. P. B. Walker, M.A., Ph.D., F.R.Ae.S., introduced his paper, *Fatigue of Aircraft Structures,* before the Royal Aeronautical Society on March 31st.

Limitations of space make it necessary to give a condensed précis of Mr. Walker's lecture and we shall, therefore, deal only with the salient points he made.

There was, he said, a lack of knowledge of the basic nature of fatigue, the result of which had been to throw the emphasis on testing and experimental work generally, whereby an empirical "working theory" of fatigue had come to be used extensively. After dilating upon the presentation of test data, the lecturer went on to consider the fatigue behaviour of structures, and observed that, although the behaviour of a complete structure naturally depended upon the behaviour of its constituent elements, there were further complications to be considered. The most important complication was the changed significance of ultimate static strength when used in reference to a structure. It could be argued that static strength had nothing to do with fatigue and that the latter should be considered on its own merits. Aircraft engineers were liable to be seriously handicapped without some such simple standard by which to judge fatigue strength. That being so, the fact had to be faced that the part which failed in a static test was not necessarily the part which failed in fatigue. The static strength of the structure as a whole was therefore no true indication of the static strength of a part which failed in fatigue.

Complete-structure Complications

Further complications arose on a complete structure, suggested Mr. Walker, through erratic behaviour of the internal load distribution. When a simple test specimen was subjected to fluctuating load in direct tension or compression, there was an almost exact correlation between applied force and internal stress. For the complete structure there was no such simple correlation. Even for static loading conditions, the determination of internal loads was extremely difficult for modern aircraft structures. When the external loads fluctuated, determination of internal response may become for all practical purposes impossible. It could be concluded that the fatigue characteristics of a complete structure could be ascertained with certainty only by testing it in complete form.

In considering the effects of fatigue in relation to aircraft design, Mr. Walker thought that the working life of an aircraft was of considerable importance in that it was limited by considerations of obsolescence, wear and tear and the general economics of aircraft operation. To disregard this limitation on life would lead to a serious loss of efficiency and it was doubtful whether the entire conception of a modern aircraft could exist if its structure were expected to have a life comparable with that of a steel bridge or a building.

Regarding assessment of the fatigue danger, although many aircraft types have come and gone without experiencing fatigue failures, it was important, the lecturer thought, to note that these were not necessarily representative of present-day aircraft, to say nothing of future types. In general, the number of fatigue failures that had occurred was much smaller than generally supposed, and a large proportion of these appeared to have been non-catastrophic, and to have been revealed on inspection. Lest this statement should lead to undue complacency, it was well to bear in mind that serious epidemics of trouble have developed in aviation from a few isolated incidents. If, for example, the first warnings of danger from flutter had been disregarded, the consequences would have been extremely serious.

Apart from such general consideration, there were specific trends which gave rise to concern for the future. The first was a tendency to require a longer working life from an aircraft, for which there were a number of reasons. First, it was a general rule that as progress was made, rate of progress declined, and hence obsolescence became less effective in curtailing the prescribed working life of an aircraft. Secondly, improvements in design from the standpoint of robustness, and improvements in methods of maintenance, were likewise extending the limit of life imposed by considerations of wear and tear. Finally, the tendency for increased initial cost of aircraft may, on economic grounds, operate in favour of retaining particular aircraft in service for a longer time.

Weather Stresses

The second reason for increased concern about fatigue in the future arose from the general tendency for aircraft to operate under more exacting conditions. Improvements in navigation and in methods of aircraft operation rendered practicable flying with less regard to adverse weather, and in any given number of flying hours an aircraft might be expected to encounter a larger number of severe gusts.

Finally, there were grounds for concern in the design trends which were being produced by the attempts to obtain more efficient structures by present-day standards, that is, structures which were still lighter for a given static strength and stiffness. Primary load was increasingly being diffused over thin sheets or transmitted to components (stringers, stiffeners, and the like) with thin sections, the whole being connected together by innumerable rivets. Thus the effect of working in material (light alloy) with inferior fatigue properties was being aggravated by the introduction of more stress concentrations.

It was clear that if fatigue became a matter of serious concern in the future the designer's task would be rendered much more difficult. Instead of having to consider two factors in design—namely, static strength and stiffness—he would have three. The effects on general design trends were largely a matter for speculation and, in any case, must depend on how serious the fatigue problem became.

Future Effects

One effect might be that some designers at least would question whether steel had not been abandoned prematurely in favour of light alloy. In any case there would be an incentive to discover materials with properties more like steel, even at some sacrifice of weight-economy.

Another effect might be a reversal of the design trends of recent years back towards earlier types of construction. Thus the extreme application of what might be described as the monocoque principle might have to be modified in favour of earlier methods with massive spars and more robust components generally.

An incentive might also be created for the investigation of glueing metal to metal as a substitute for riveting. Progress had already been made in the development of a metal-to-metal glue, but it was too early to assess its prospects of universal acceptance.

In considering prospective design trends, regard must be paid to the fundamental research that was proceeding all the time. A radically new situation would be created, for example, by discovery of material with better fatigue properties, or by discovery of an easy method of annealing structures *in situ*. Furthermore, the development of a satisfactory theory to account for the basic phenomenon of fatigue might throw new light on the whole problem.

The rear main leg unit. In addition to the twin Goodrich brakes on each wheel, a tail parachute is fitted.

Stratojet Undercarriage

Tandem Main Wheels Simplify Stowage in American Jet Bomber

AN unorthodox undercarriage is one of the numerous novelties incorporated in the Boeing XB-47 Stratojet six-jet bomber. The two main legs, each with twin wheels, are arranged in tandem under the fuselage, instead of under the wings, and two small outrigger wheels are provided to hold the aircraft upright when at rest. This arrangement eases the undercarriage stowage problem —always a headache to designers. The weight and size of aircraft wheels are steadily increasing, while engine nacelles and wings tend to become smaller and thinner. On the XB-47 the nacelles required to house a normal-type undercarriage would have been disproportionately large; by adopting the existing scheme, the designers appear to have effected a considerable reduction in both weight and complication. Development was less involved than is normally required and the task of stressing the acutely swept-back wing was eased.

The undercarriage has so far proved satisfactory under all take-off and landing conditions. To avoid the possibility of skidding—particularly on the snow- and ice-covered runways from which many of the initial flights have been made—an effective tail-parachute brake is at present fitted. Although no decision has yet been taken, this might well be a permanent feature on production aircraft. Provision of an emergency wheel-lowering device should also be comparatively easy and, in the event of this failing also, the fault should be accessible from inside the fuselage.

The tandem undercarriage is not new, such a scheme having been used on an experimental Messier monoplane built in 1933; but the XB-47 is the first modern aircraft to incorporate the idea. An interesting comparison is afforded with the novel four-legged undercarriage of the Vickers Windsor bomber of the late war years.

The eighteen built-in A.T.O. rockets, nine of which are seen to advantage in the uppermost view, deliver a combined thrust of 18,000 lb. Each of the six General Electric TG-190 axial-flow turbojets has a designed rating of 5,000 lb static thrust, and more powerful units are proposed to permit operation at weights far greater than the 125,000 lb announced for the first prototype.

The outrigger wheels are fully castoring and retract forwards into the nacelles.

AIR HORSE

Design Analysis of the Largest and Heaviest Helicopter in the World

WHEN the Cierva W. 11 Air Horse was first exhibited to public view at the S.B.A.C. Farnborough Display last September, it created an enormous amount of interest. To the layman it presented an uncouth picture of almost Wellsian fantasy, but to the technician it appeared as the fruition of years of painstaking development and a very considerable stride forward in the art of rotary wing aircraft.

Over the years, *Flight* has published many articles covering the process of development which forms the pedigree of the Air Horse, but we feel it relevant to restate a synopsis of the main line of development, if only to give perspective to the review of the aircraft itself.

Helicopter development in this country really sprang from the W.3 jump-start Autogiro, built in 1933 by G. and J. Weir, Ltd., as licensees of the Cierva Company. The problems involved in this aircraft made transition from the autogiro to the helicopter a logical step, and as a result, Mr. C. G. Pullin, who was chief engineer of the Weir rotating wing department, started to work on such a project. An enormous amount of pioneer research was entailed and it necessarily took a good deal of time. At last, however, the results of these years of labour were embodied in the twin side-by-side rotor W.5. This aircraft, which made its initial test flight in June, 1938, was the first British helicopter to achieve free controllable flight. (Incidentally, it is worth noting that Igor Sikorsky did not make his first successful helicopter flight until 1940.)

The following year, 1939, the W.6 made its appearance and flew successfully: a somewhat larger, metal, 200 h.p.-engined version of the little W.5, it employed the same basic configuration. Work on helicopters then unfortunately had to give way to the urgent demands of war, and it was not until 1944 that progress could be resumed.

Although conceived chiefly as a solution to the omnipresent problem of torque reaction, the Pullin side-by-side rotor layout had proved to be possessed of excellent flying and control characteristics, although fore and aft stability in the pitching plane was known to be a subject for improvement. Thus, when thoughts on helicopters were once more engaging attention, a third, balancing, rotor was envisaged to give "tail surface" compensating effect. A full-sized mock-up was made in the form of a skeleton employing hardly any fuselage worthy of the name, and it was this design study which was first christened the Air Horse (*Flight*, July 4th, 1946). Tunnel tests were made at the Royal Aircraft Establishment during 1946 with the three-rotor configuration, as a result of which the theory was proven that the third rotor should be positioned at the front of the aircraft rather than at the back.

Within the present ambit of knowledge and practicability, an effective limit is set on rotor diameter to something of the order of 50ft., and as the functions of lift and control are dependent on rotor parameters, the amount that can be lifted is, to a certain extent, dependent on the number of rotors employed. Thus, each rotor of the W.11 has something of the same ratio of lifting capacity as the Bristol 171 and the Sikorsky S.51, the three rotors enabling the aircraft to fly at an all-up weight of 18,000 lb.

Again, whereas the first Air Horse mock-up was conceived virtually as an aerial crane, either for carrying large tanks of insecticide for crop-spraying, or for transporting guns or similar high-density awkward loads over rivers, it was realised that as a basic stress-bearing structure was required for anchorage of the rotor outriggers, etc., it might just as well be of stressed skin construction and so form an enclosure providing internal stowage capacity. The result was the W. 11 in its present form. First free flight was made on December 7th, 1948, with Mr. H. A. Marsh at the controls, since when the aircraft has done a considerable amount of flying in its test programme.

In plan, the rotor hubs are disposed as the apices of an equilateral triangle, but the vertex angle formed by the shaft axes of the rear rotors is 85 deg., the transverse centre-to-centre distance between the rear hubs being 48 ft. With a rotor diameter of 47 ft, this disposition gives a tip clearance of 12 in between any two rotors. In side elevation, the plane through the rotor centres lies at 4 deg. to the fuselage axis, so that in the hovering case, the fuselage is 4 deg. tail down : this helps in the forward flight condition, for the fuselage then takes up an attitude slightly less nose down than would otherwise obtain.

As to physical layout, the rectangular-section, tubular fuselage embodies the two-seat, side-by-side dual control cockpit in the upper part of the cigar-shaped nose, enclosed by a Perspex cupola affording a very wide field of view. On the after side of the cockpit bulkhead are a pair of folding seats for extra crew members. The crew entry door is on the port side opening into a "vestibule" rearward of which is the engine room. In the centre of the rear part of the "vestibule" is the nosewheel strut, which projects upward through the floor and is anchored at the head to a built-up box beam spanning the roof at this station.

Immediately aft of the nose strut is the cooling tower. This has a circular, mesh-guarded inlet in the roof at the root of the forward rotor outrigger, and with a bell-mouth entry gives on to the variable-pitch cooling fan mounted in the upper part of the trunk. With ten magnesium alloy cast blades, beneath eleven curved inlet vanes around a basin spinner, the fan is shaft-driven from the distribution drive gearbox and, by virtue of the variable-pitch blades, permits a simple and extremely accurate control of engine temperature. In the base of the cooling tower are the radiators for coolant, and engine and transmission oil systems, collectively housed in a cast light-alloy tray, and venting to atmosphere through a mesh grille in the underbelly of the fuselage.

Behind the tower is a braced skeleton box-work enclosing and supporting the Servodyne jacks and the rocking-beams rods and quadrants of the rotor powered-control transmission system. This is a somewhat complex matter which, we feel, fully warrants an article to itself, and thus we propose to deal with the whole subject of control in a second instalment which will be included in next week's issue. However, suffice for the moment to say that, from the cockpit controls movement is given by push-pull rods to the Servodynes, the output sides of which power the transmission linkage up to the rotor hubs, whereby the requisite blade pitch change is brought about. Flight manœuvring is dependent upon inter-rotor thrust vector amplitude and inclination, which is obtained by combinations of collective and cyclic pitch-change of the blades.

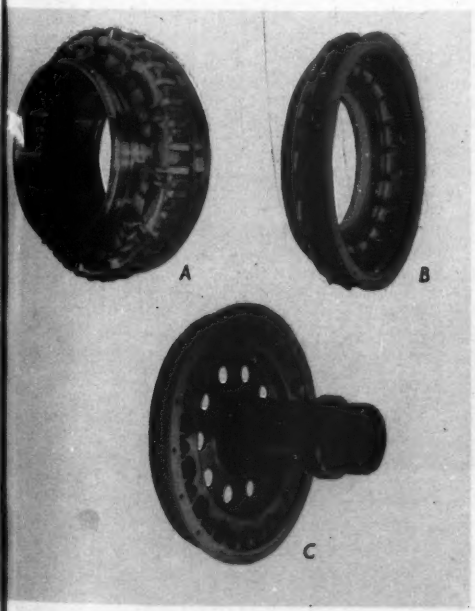
Power Installation

At each side of the roof abreast the control bracework is an oil tank, one, of 10 gallons capacity, for the engine, and the other, of 5 gallons capacity, for the transmission system. Closing the rear of the engine room is a bulkhead and in the roof, running forward to the thwartships beam at the nose strut station, are two channel-section built-up beams. From the base booms of these, triangulated tubular trusses terminate in the mounting points for attachment of the engine. The engine itself is a Rolls-Royce Merlin 24, single-stage single-speed supercharged unit, giving 1,645 b.h.p. for take-off at 3,000 r.p.m., and 18 lb/sq in boost.

The engine faces forward, the carburettor intake air being brought in through louvred vents on each side of the fuselage, giving into plenum chambers across which are carried Vokes Aerovee filter trays. Outlet from the plenum chambers is via concertina gaiters into a duplex elbow casting with a single outlet mouth to the updraught carburettor. Butterflies in the elbows give selection of cold (ambient) air, or warm (internal) air inlet sources : there is, of course, no ram in either case.

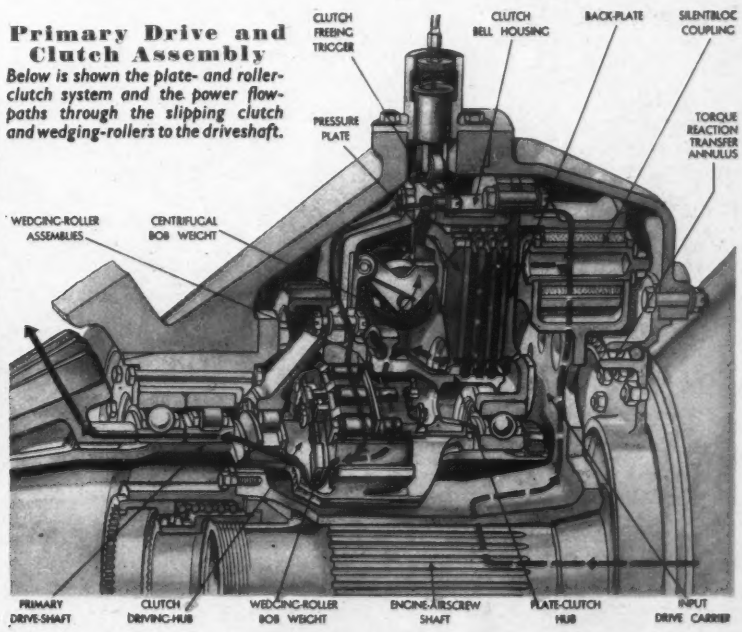
One of the difficulties associated with a submerged engine installation is that of exhaust cooling. The Cierva solution

On the left are shown detail views of three elements in the primary drive assembly. The wedging-rollers are shown at A: the annulus carrying the bobweights for the plate clutch is at B: whilst at C is shown the input drive carrier with its Silentbloc-bush couplings to the clutch housing.



Primary Drive and Clutch Assembly

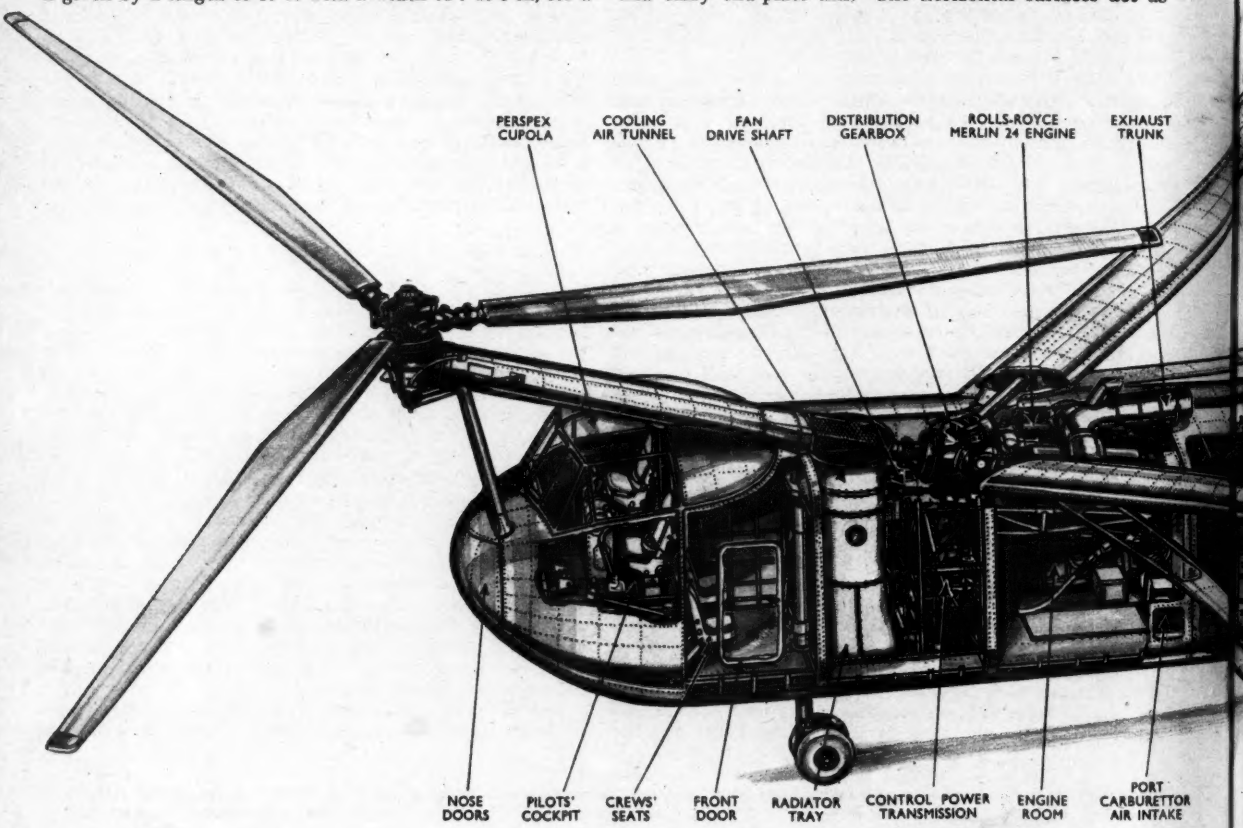
Below is shown the plate- and roller-clutch system and the power flow-paths through the slipping clutch and wedging-rollers to the driveshaft.

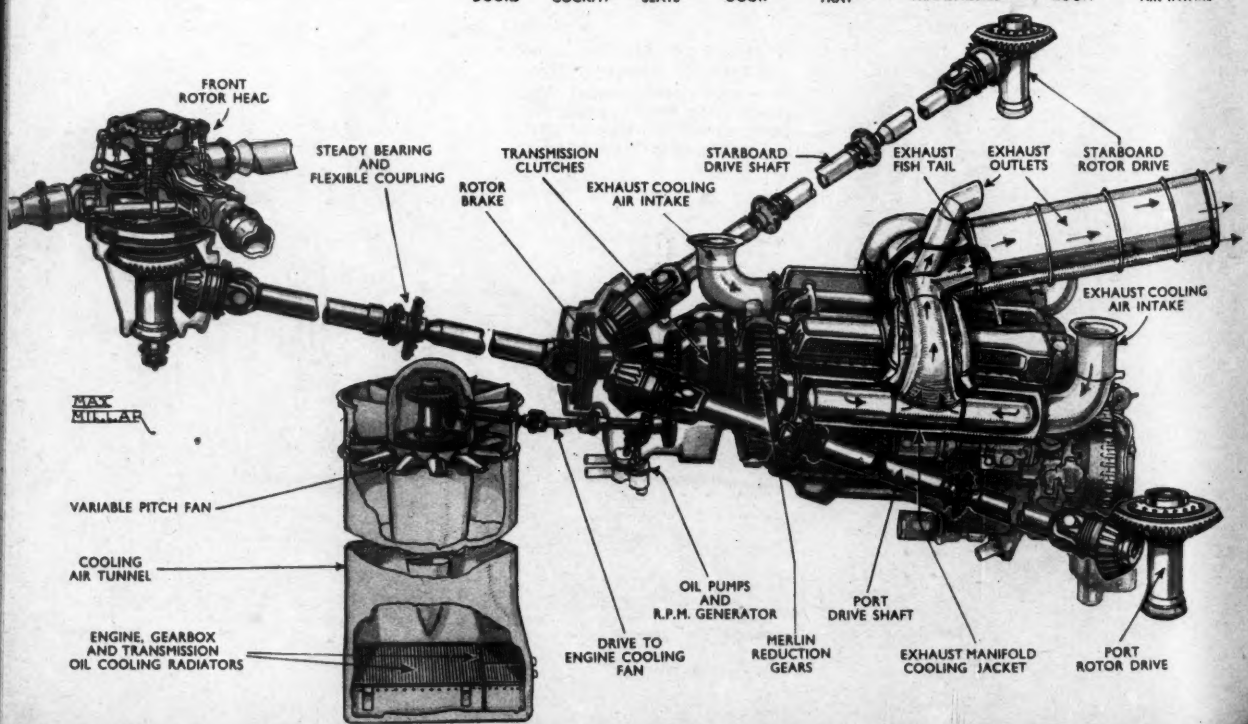


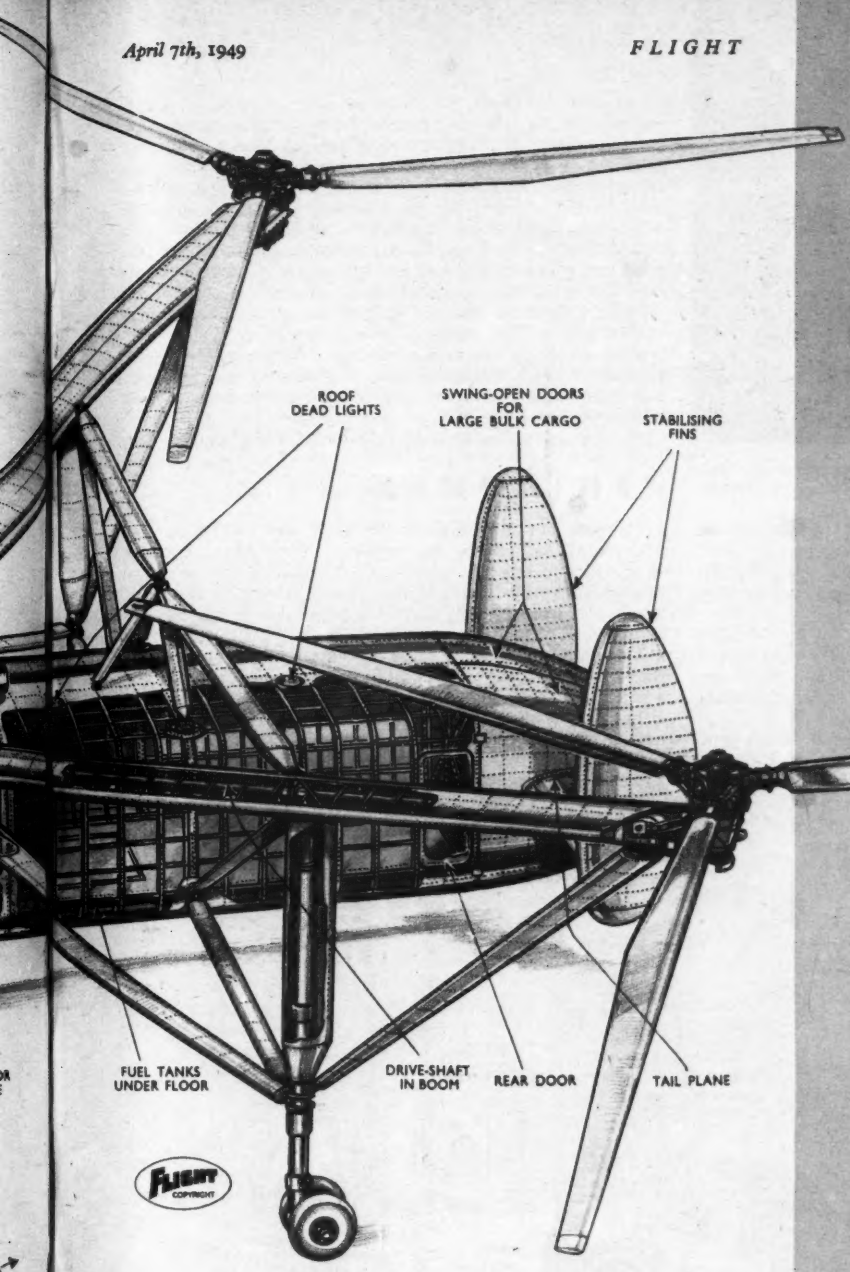
AIR HORSE . . . . is to join each manifold with a cross-over bridge duct, and jacket the whole assembly. The exhaust outlet is arranged as a fishtail in the core of the jacket outlet, so that ejector action induces a cooling airflow into the jacket through four inlet branches, the cooling air being expelled in common with the exhaust.

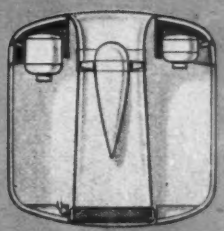
Behind the engine room a fuselage volume of 800 cu ft is given by a length of 19 ft with a width of 7 ft 6 in, for a height of 5 ft 8 in. Entry is afforded through a door at the rear of the cabin on the port side, the threshold height of which is 3 ft 9 in, whilst the whole tail of the fuselage is arranged as a cigar point, split vertically on the centre-line to form swing-open doors, the threshold height of which is 3 ft 6 in. A system of friction braking and positive latch-locking is embodied in the door mechanism.

Horizontal tailplanes are cantilevered off the tail doors and carry end-plate fins. The horizontal surfaces act as

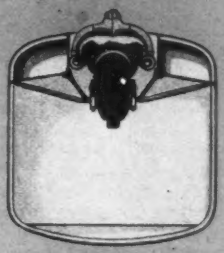




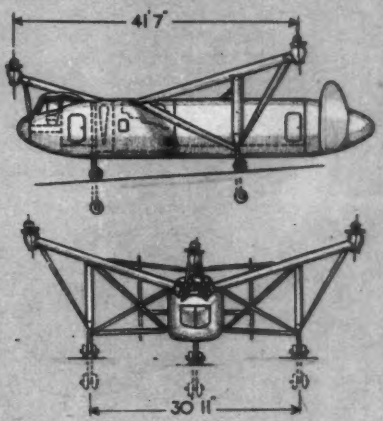


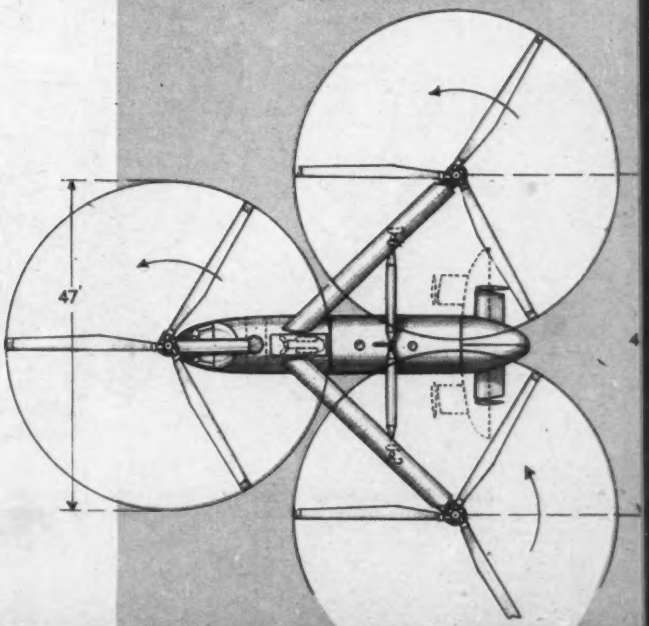


Section at cooling tower showing engine (left) and transmission. (right) oil tanks.



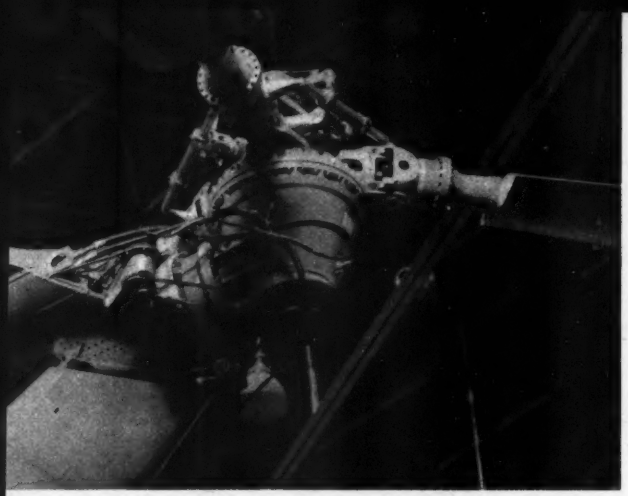
Section at engine showing transverse mounting trusses and exhaust bridge ductings.





In this excellent cut-away drawing of the Air Horse, "Flight's" chief artist, Max Millar, has illustrated with admirable clarity the physical characteristics of this most unusual aircraft. The power installation, undercarriage geometry and cockpit layout are clearly indicated, and the large volume available either for passenger accommodation or freight stowage is readily appreciable.

At left is a detail showing the essential elements of the rotor transmission system, engine cooling and exhaust cooling installations. The engine is inclined upward toward the front rotor at 7½ degrees, which simplifies shaft angularity problems, and speed reduction is made both at the engine and at each rotor hub.



Detail of rotor head showing mounting, control transmission and blade articulation. The drag hinges and snubber units are evident.

damping media for pitching oscillation, whilst the vertical surfaces can be moved a few degrees to give rudder effect compensation for torque reaction unbalance. In addition to this function they provide additional keel surface area aft of the c.g. as an aid to directional stability.

One aspect of the three rotor configuration which renders it so valuable is that c.g. position is relatively uncritical, the movement range being of the order of 3½ to 4 ft fore and aft, whilst laterally it is quite uncritical within the practical loading limits of the aircraft.

The drive transmission from engine to rotors is not complex, although it embraces a large number of bits and pieces. (An excellent survey of the design considerations involved was given by Mr. K. Watson, the chief mechanical engineer, in a paper read before the Helicopter Association —*Flight*, March 3rd, 1949.) The normal Merlin reduction gear of 0.42:1 is retained, the engine's airscrew shaft giving drive into the distribution gearbox carried direct on the front of the engine. Torque reaction is fed back into the engine casing through a serrated coupling between distribution gearbox and engine reduction gearbox, whilst forward extensions of the fore and aft engine mounting beams take the weight of the distribution gearbox.

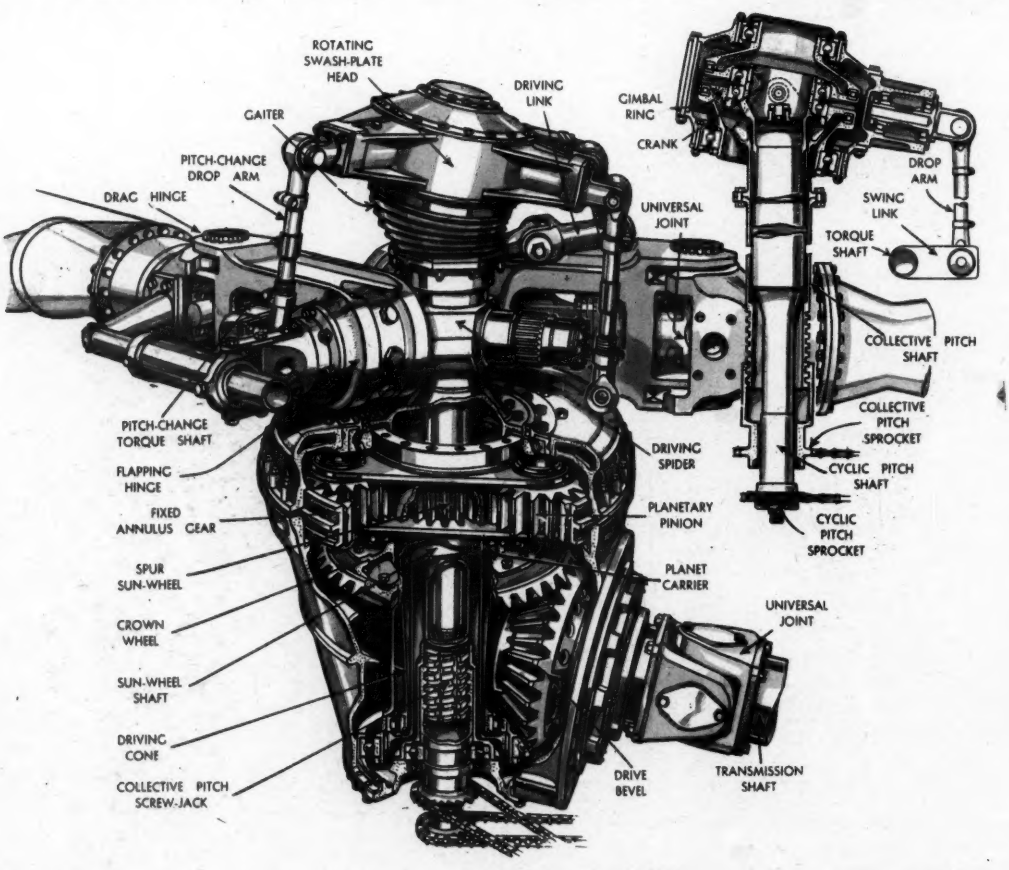
To the airscrew shaft is splined an input drive carrier with a twin-walled scalloped skirt, carrying 15 Silentbloc-bushed couplings to the bell housing of the clutch assembly. The clutch itself is used only during running up; at above 100 rotor r.p.m., the drive path changes and the clutch becomes inoperative.

Pressure is applied to the 5 Ferodo and 4 steel clutch-discs

AIR HORSE . . . .

by means of 18 G.E.C. heavy-alloy bobweights which, under centrifugal force, bear against the pressure plate and so squeeze up the disc sandwich. The steel discs are keyed to the clutch hub which, through a wedging roller assembly, transmits drive to the clutch driving-hub splined to the primary drive shaft.

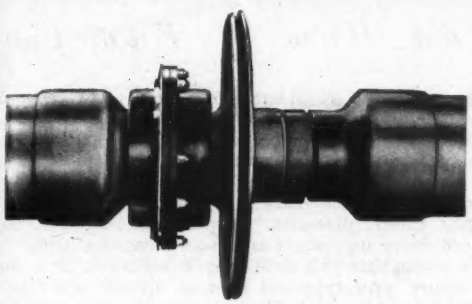
The plate clutch is designed to slip at power flows above that necessary for approximately 100 rotor r.p.m., and when this occurs, the drive is taken up through a second, larger, wedging-roller assembly between the clutch bell housing and the clutch driving-hub. Should the rotors tend to overspeed, the wedging rollers will act as freewheels. The advantage of this scheme is that, even if the engine is rapidly

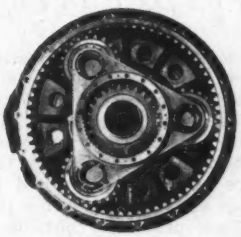


Detail of hub gearbox and blade articulation, showing secondary bevel and epicyclic sub-stages of gear reduction, and head elements of pitch-change mechanism. The inset at top right shows the interior of the swash-plate assembly for cyclic pitch change.

opened up, the rotor drive take-up remains smooth by virtue of clutch slip, and snatch loads are thus obviated. A triggering mechanism is incorporated in the bobweight linkage, so that the weights may be held down in order to allow the engine independently to be run up to maximum r.p.m.

The primary drive shaft is supported at the centre in large roller and ball bearings carried in an annulus bolted into the gearbox casing, and the nose of the shaft runs in a slightly smaller roller bearing supported in the gearbox front cover. Immediately forward of the centre bearings, the main driving bevel is splined to the shaft, whilst at the forward end of the shaft, in front of the nose roller, is splined a ring to which is bolted the driving half of the universal joint at the foot of the front rotor transmission shaft. The drum of the rotor brake is bolted to the splined ring: this brake, which is of normal Girling expanding, twin-shoe pattern, by reacting on the primary drive shaft thus serves all three rotors.





At left is a detail of a rotor shaft coupling, showing the enclosed ball-type steady bearing and flexible-plate joint, whilst at right is a plan view of the epicyclic sub-stage reduction in a hub gearbox.

On top of the main driving bevel is a wheel which gives drive through a torsion quill shaft to the Lockheed hydraulic pump mounted on the head of the gear box, and to the rotor tachometer. By the use of this second hydraulic pump, which is driven from the rotor side of the clutch, provision is made for maintenance of full flying control (which utilizes the Lockheed hydraulic Servodyne system) of the autorotating rotors in the event of engine failure. Bolted on the front of the clutch bell housing is a toothed ring through which power is transmitted to two layshafts, the port member for cooling-fan drive, and the starboard member available as an auxiliary drive if required. On each layshaft is a bevel drive to vertical shafts, the port assembly driving the vacuum pump and engine tachometer generator, whilst the starboard shaft drives the transmission oil pumps.

Drive Distribution

Drive to the front rotor is given virtually direct off the nose of the primary drive shaft, but for the port and starboard rotors, transmission is by means of bevel pinions meshing with the main driving bevel. These are each in turn hub-splined to a cup transfer-member, to the rim of which is bolted the driving half of the lower universal joints of the transmission shafts. Each of these latter is a light alloy tube of 4¼in diameter and 9 gauge wall thickness. Speed reduction between engine and rotors is in two stages, i.e., the normal engine reduction of 0.42 : 1, and a further reduction of 0.174 : 1 at each hub. By this means, the torque carried by the transmission shafts is kept reasonably low.

Each rotor shaft is carried in enclosed ball-type steady bearings, housed in transverse diaphragms across the interior of the boom, and on the engine side of each bearing the shaft is divided and joined by flexible steel plates to compensate any whip in the drive. The shafts terminate at the head in universal joints, the angles through which are identical with those of the universals at the feet, this measure resulting in substantially constant-velocity drive.

All three rotor gearboxes and hubs are identical and interchangeable, but are individually set relative to the fuselage at varying inclinations, in order both to give dihedral effect and a measure of torque reaction compensation. Each hub gearbox, a D.T.D. 289 magnesium casting, is bolted to a light alloy adaptor casting carried in the end of the outrigger boom, the output half of the upper universal of each transmission shaft being bolted to a splined driving cup in the bore of the driving bevel; in fact, this is a reverse similitude of the coupling at the input end of each shaft.

We have already stated that the reduction between engine and rotors is made in two stages, but the second stage, at each hub gearbox, is in fact divided into sub-stages, the first of which, with a ratio of 0.65 : 1, occurs between the driving bevel and the crown wheel. The actual drive path in each hub gearbox is somewhat circuitous. The crown-wheel is carried at the head of a truncated cone, the base mouth of which is splined to a vertical shaft running coaxially within the cone, up to the sun-wheel of the epicyclic train, in which the second sub-stage reduction ratio, of 0.266 : 1, is vested. The sun-wheel is a plain spur gear, giving drive to three planet pinions reacting against a fixed annulus dowelled to the gearbox casing. The planet carrier is splined direct to the base of the rotor hub spider and thus forms the actual hub driving member. It is carried in twin-row, Timken taper-roller bearings at the head, which take the static and flight loads of the rotor, and a large roller bearing at the base, which caters for journal loads.

Blade Articulation

The rotor hub spider is a high-tensile steel forging in the form of a stem splined to the planet carrier and embodying three spokes which form the pivot members, with needle roller bearings, for the massive flapping links. These latter are light alloy forgings and are each formed at the outer end with twin forks in which the blade root fitting pivots, also in needle roller bearings, to form the drag hinge. Off the root of the outer half of the drag hinge is an arm picking up the piston rod of a Lockheed oleo-pneumatic snubber unit anchored to the flapping link to restrict azimuthal accelerations, *i.e.*, velocity variations in the angular dispositions of the blades. Each blade is individually snubbed.

On the drag hinge axis is a universal joint at the outer end of a torque shaft through which blade pitch change is effected. The blade itself is carried in twin-row Timken taper-roller bearings in the outer half of the drag hinge link. At the inner end of each torque shaft is a swing-link carrying a twin-row taper roller bearing at its outer end, in which is pivoted a spindle to which the pitch-change drop-arm from the swashplate is pin-jointed at its foot. The swashplate assembly is carried at the crown of the rotor hub mechanism and is employed to translate control input motion into blade pitch-change.

Thus far is properly the limit of the rotor drive transmission system, although in carrying the description to its logical conclusion we have necessarily had to deal with the blade articulation linkage. The mechanical action of blade pitch-change will, however, be included in the following issue, together with an examination of the hydraulic powered-control system and the inter-rotor control distribution for flight manœuvre.

C. B. B-W.

(To be concluded next week)

By M. G. K. Byrne, A.F.R.Ae.S.*

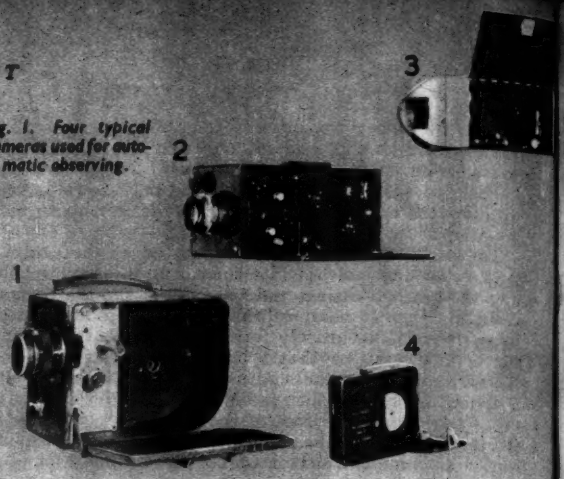


Fig. 1. *Four typical cameras used for automatic observing.*

TEST INSTRUMENTATION

Automatic Observation and How it Functions

As the title of this article includes the word "Instrumentation," it is logical to start by defining a term which, until recent times, was associated with the arranging of music for a combination of instruments. Instrumentation is a collective noun covering every procedure apertaining to instruments, whether for standard or test purposes: but in this instance only the latter will be considered. Instrument readings are recorded during test flights in order to gain data not previously obtainable and to shorten the test-flying period: these time histories are used to augment, and give reasons for, the test pilot's assessments of controls, aircraft behaviour, and so on.

One's conception of instrumentation should not be obscured by recollections of a pre-war film in which a "super fighter" was dived at terminal velocity and began to shed its wings. Before baling out the pilot wrenched the dashboard plus instruments from the cockpit mounting and floated to earth with them clutched tightly to his manly chest. Upon landing, with a resounding crash, all the instruments were found still to be indicating the correct r.p.m., speed, height, etc.—a most useful attribute!

In the era of low-performance aircraft there was adequate time for a pilot to note the requisite A.S.I., altimeter, temperature and pressure readings. For example, in 1935, if the performance figures on a Gloster Gladiator, climbing at combat rating, were recorded at intervals of 1,000ft. the pilot had approximately half a minute in which to write down each set of results. To-day, a machine such as the Gloster Meteor IV has an initial rate of climb of 7,350ft/min., i.e., a thousand feet is now achieved in just over eight seconds.

An additional consideration is that flight research has made such strides that the aerodynamicist now demands a complete history of the aircraft's behaviour. To satisfy the specifications of the Air Ministry it is now obligatory to measure air speed, height, aircraft attitude, accelerations in the three planes, all control angles and forces, engine speed, pressures, temperatures, etc.—in fact, to record every movement and force associated with flight.

In order that this data may be obtained and analysed at leisure, prototype and research aircraft are fitted with automatic observers. These devices consist fundamentally of an instrument panel suitably lighted so that ciné cameras can photographically record the various dial readings. The films so obtained are processed and projected on to screens at a magnification greater than the original, and the instrument readings are first of all accurately logged and then plotted.

In dealing with the component parts of an automatic observer, consideration must first be given to the cameras; in the majority of instances these are of 35 mm type, although the range of films actually varies from 4in in width down to 16 mm. According to the task in hand, the cameras may be set to take single shots or may have their running speed varied from one frame per minute to 60 frames per second: the former exposure rate would be suitable for a long-range endurance flight and the latter for any high-speed manœuvre.

Four typical cameras which have been utilized for widely differing tests are shown in Fig. 1, namely:—

(1) The Vinten "K," which has a magazine holding 200ft of 35-mm film and runs at 16 or 24 frames per second.
(2) A camera specially designed for automatic-observer work.

* *The author is Flight Observer for Blackburn and General Aircraft, Ltd.*

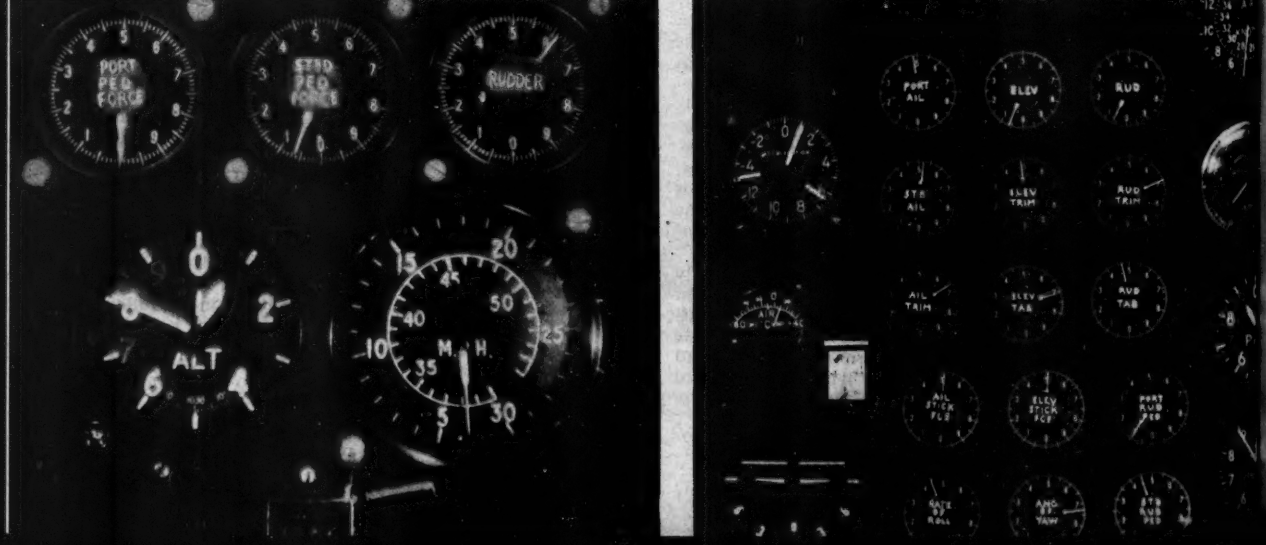


Fig. 2 (left). *An instrument panel photographed by standard lighting. The usual reflections and shadows are entirely eliminated by the use of polarized lighting, as shown in Fig. 3 (right). Note the strain shadows in the boost-gauge glass.*

Test Instrumentation . . . . .

the F.58, which has a 50ft spool of 35-mm film and may be varied in speed from predetermined intermittent exposures to continuous running at 6 to 12 frames per second.

(3) The standard 16-mm G.42 camera-gun, adapted for short-range work, and with a magazine of 25ft capacity.

(4) A 16-mm gyro gun-sight camera holding 15ft, which has also been suitably modified.

One sidelight for students of psychology and languages is to witness the facial expressions and hear the enlightened talk of a pilot who has performed a protracted series of intricate tests, only to discover the camera has failed to operate:

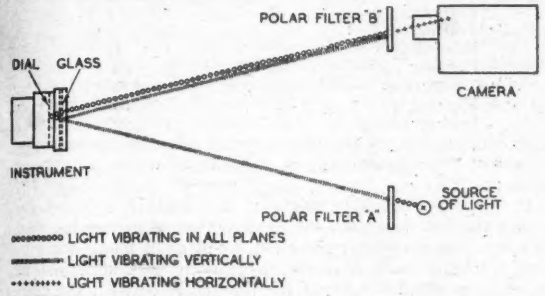


Fig. 4. The principle of photography by polarized light.

Two types of illumination for the automatic observer may be used, ordinary direct lighting or polarized light; the former is self-explanatory, but the latter is best comprehended by studying Fig. 4. The source of light is a normal electric bulb, the rays of which are vibrating in all planes, and these meet the polar filter A which allows only the vertical vibrations to proceed to the instrument panel. On striking the glass of an instrument some of the light is reflected back towards the camera, still vibrating vertically, but is stopped by polar filter B, which permits only horizontal vibrations to pass. The light which passes through the instrument face-glass is, however, split up and set vibrating again in all planes; it is thence reflected back from the dial of the instrument towards filter B, to pass as horizontally vibrating rays and be recorded on the film.

Elimination of Glare

In Figs. 2 and 3 is illustrated the difference between normal illumination, where the instrument bevels, the glass and even the screwheads all reflect glare back to the camera, and polarized light, in which only instrument markings and needles are apparent. The one disadvantage of polarized light is that, due to the density of the filters, the source of illumination must be approximately doubled in intensity. Is should be noted that polarized light has, in addition, the property of exposing the lines of strain in glass. For example, in Fig. 2, the radial reflections on the boost gauge are the internal strains within the glass due to tightening down the front cover.

Many of the instruments which are used are familiar cockpit items such as air-speed indicators, altimeters, r.p.m. indicators, and boost gauges, but for the purposes of automatic observation in flight-test work they are sensitive, specially calibrated versions of the standard instruments. To a large extent, remote-indicating instruments are installed, a type frequently employed being the Smith "Desynn" position-indicating equipment, which provides a continuous indication of the displacement of a control or surface. For control angles the transmitter should be located as close as possible to the surface to be measured in order to eliminate any intermediate deflections or backlash. Specialized equipment includes such items as electrically driven gyros for measuring pitch and roll, wind vanes for angular displacements, accelerometers, suspended static heads, CO detectors, V.G. recorders, vibrographs, and strain-gauge and electronic equipment.

An automatic observer as a whole is constructed upon a compromise between the photographic ideals and the restrictions of space within the aircraft to be tested. Obviously, the problem presented by a large transport is negligible compared with that of introducing the necessary equipment into the confined interior of a fighter. Fig. 5 illustrates a unit installed in a Fleet Air Arm prototype: the camera, complete with polar filter, can be seen to the left, the banks of light with polar filters in front, and finally the panel containing over twenty instruments.

The whole structure is mounted on rubber shock-absorbers in order to eliminate vibration, with all the wiring and piping led back to accessible connections. The framework itself combines ease of assembly with lightness and rigidity; rigidity is critical, in that any relative movement between the camera and the instruments will result in blur. As a matter of interest, the unit illustrated weighs 42 lb, the camera 8½ lb, and the remainder of the equipment, in various parts of the aircraft, 113 lb, giving a total of 0.7 per cent of the aircraft's tare weight. On large multi-engined machines weights of several thousand pounds are common.

In order to illustrate study of the data obtained from all this complicated and expensive equipment, the installation for the Naval prototype already mentioned can well serve as an example. One of the most stringent requirements an aircraft of this type is required to meet is that for landing on an aircraft-carrier deck. The necessity for low landing speed, combined with light, effective controls, presents a problem which can best be comprehended by studying a film of the movements and forces involved.

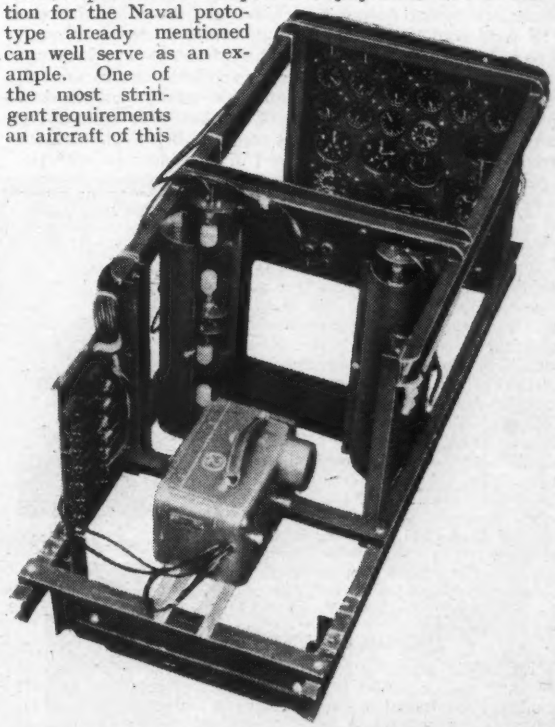


Fig. 5. Automatic observer for a fighter, showing camera, light-banks with filters, and instrument panel.

Shown in Fig. 3 is a print from one frame of a film which was running through an F.58 camera at a rate of 16 frames per second. The instruments involved, reading vertically from left to right, are: accelerometer, air temperature, artificial horizon, port-aileron angle, starboard-aileron angle, aileron-trimmer angle, aileron stick-force, rate of roll, half-second light, elevator angle, elevator trimmer angle, elevator spring-tab angle, elevator stick force, angle of yaw,

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rudder angle, rudder-trimmer angle, rudder spring-tab angle, port rudder-pedal force, starboard rudder-pedal force, A.S.I., boost r.p.m. and altimeter.

If recordings are plotted against a time-base a series of curves can be drawn. For instance, in following the landing through, we obtain speed decreasing with time, the elevator angle and loads during the approach, and the final touch-down, which is indicated by micro-switches on the undercarriage legs. These micro-switches energize lights on the panel and prove whether all three wheels touch at once or not; this is necessary because the load and elevator angle must be correlated to the ability to get the tail down.

In addition, there are the forces and angles for all the flying controls; these enable the load to be ascertained for holding-off on the landing approach, picking up a dropped wing, straightening up on to the true flight-path, or for performing other corrective manœuvres. Any deviation from the ideal flight-path is indicated by the standard blind-flying instruments so that, if a wing drops 10 deg as shown by the artificial horizon, the time to get the aircraft level again is recorded, together with the aileron loads, angles and rate of roll involved in the ensuing action.

The r.p.m. and boost curves prove whether the pilot really carried out a power-off landing or whether a burst of throttle was required to achieve a three-point attitude. The accelerometer records the standard of the touch-down—a recording up to $+\frac{3}{4}$g may be considered to be a landing, but everything above that figure is regarded as an arrival.

Finally, in order to consider the time factor involved in instrumentation, the instance of a pilot who is carrying out a series of rates-of-roll tests can be taken. The camera would be running at a high speed in order to cope with the rapid fluctuations of the needles of the instruments, which would be registering speed, height, engine conditions, stick-force, aileron and tab angles, rate of roll and time interval. Thus at 24 frames per second 50ft of film would be used in 25 sec., and with ten instruments on the panel there would be a total of 6,000 readings to log The film has to be unloaded, developed, fixed, washed, dried and titled, all of which takes approximately $1\frac{1}{4}$ hr.

With one person reading and one writing, the film results could be logged in 8 hr. and the converted figures picked off the calibration curves in another 3 hr. The plotting of this information would take approximately 5 hr. and the interpretation a further 2 hr. Thus the following rather astonishing summation is achieved:—

	Man-hours
Flying time	1/6
Testing	1/44
Processing	$1\frac{1}{4}$
Logging	16
Converting	6
Plotting	10
Interpretation	2

In other words, 25 sec. of test flying with the cameras running will produce over 35 man-hours of work; a ratio of 5,000:1.

In practice, actual times are considerably reduced by giving the film less than the ideal period of processing and by accelerating drying. The employment of teams for logging, plotting, and so forth, will, with wise supervision, decrease to a marked degree the time lapse between the conclusion of the flight and the final interpretation of the results. On some occasions pin-point results of maxima or minima may provide sufficient evidence of the effect of a modification to enable the design staff to plan their next move, and an experienced technician can readily obtain spot readings by running the film through a projector.

R.Ae.S. PRESIDENT

IT is announced that Sir John S. Buchanan, C.B.E., F.R.Ae.S., A.M.I.Mech.E., has been elected President of the Royal Aeronautical Society for 1949-1950, and will take office in May. He has held the following appointments: Assistant Director of Aircraft Research and Development, Air Ministry; Superintendent of Technical Development, Farnborough; Deputy Director of Technical Development, Air Ministry; Deputy Director-General of Production, Air Ministry, 1938; Director-General of Aircraft Production (1941) and Assistant Chief Executive (1943), Ministry of Aircraft Production; technical director, Short Bros. and Harland, Ltd., 1945-48. Sir John is Chairman of the London and South Eastern Board for Industry and a member of the Advisory Committee for Higher Technological Education. During the past year he has been Vice-President of the R.Ae.S.

Sir John Buchanan

IMPORTS AND EXPORTS

THE official monthly returns for February, 1949, show that during that period Britain's exports of complete aircraft numbered 81 machines, representing a value of £1,730,144. February imports of aircraft amounted to 11, valued at £188,623. A detailed summary appears below.

	Quantities			Value	
	Feb., 1949	Jan.-Feb., 1948	Jan.-Feb., 1949	Feb., 1949	Jan.-Feb., 1949
				£	£
IMPORTS :—					
Complete aircraft (number)	11	8	18	188,623	270,748
Aircraft parts (value) ...	—	—	—	531,772	1,029,962
Totals	11	8	18	720,395	1,300,710
EXPORTS :—					
Complete aircraft (number)	81	203	197	1,730,144	2,634,728
Engines (number)	121	233	263	293,786	548,183
Rubber tyres (number) ...	1,896	3,740	3,463	16,638	59,997
Other items (value) ...	—	—	—	752,759	1,716,342
Totals	2,098	4,176	3,923	2,793,327	5,959,250

FORTHCOMING EVENTS

April 7th.—Guild of Air Pilots and Air Navigators of the British Empire: Annual Dinner, Londonderry House.
April 7th.—Royal Aeronautical Society: "Investigation of Aircraft Accidents in Relation to Aircraft Design," A. Cdre. Vernon Brown, C.B., O.B.E. M.A., A.F.R.Ae.S.
April 8th.—The de Havilland Aeronautical Technical School: 21st Anniversary Ball, Hyde Park Hotel.
April 9th.—A.T.A. Association: A.G.M. and Re-union, White Waltham.
April 12th.—R.Ae.S. (Belfast): Annual General Meeting.
April 13th.—R.Ae.S. (Leicester): Annual General Meeting and Members' Papers.
April 13th.—R.Ae.S. (Brough): "Brabazon Aircraft," F. H. Pollicut.
April 15th.—Institute of Navigation. "The Influence of Echo Sounding." A. J. Hughes, O.B.E.
April 18th.—Liverpool Chamber of Commerce: Air Display, Speke.
April 18th.—United Services Flying Club: Air Display at Elstree in aid of Soldiers, Sailors and Airmen's Families Association.
April 19th.—R.Ae.S. (Graduates' and Students' Section): "The Meaning and Measurement of Stability Derivatives," P. Fink, B.E.T.
April 20th.—R.Ae.S. (Portsmouth): "Design for Production," W. Thorn.
April 21st.—Royal Aeronautical Society: "High Lift Devices and their Use," R. R. Duddy, A.F.R.Ae.S.
April 21st.—R.Ae.S. (Gloucester and Cheltenham): Annual General Meeting. Followed by film "Atomic Physics," at Gloucester.
April 26th to 28th.—R.A.F. Golfing Society: Spring Meeting at Berkshire Golf Club, Ascot.
April 27th.—R.Ae.S. (Weybridge): "Present Day Problems in Safety Requirements," W. Tye, O.B.E., B.Sc., F.R.Ae.S.
April 28th.—Royal Aeronautical Society: The 37th. Wilbur Wright Lecture. "The Aeronautical Research Scene—Goals, Methods and Accomplishments," Dr. Hugh Dryden, F.R.Ae.S.
April 28th.—R.Ae.S. (Coventry): Annual General Meeting and film.
April 28th.—R.Ae.S. (Manchester): "Rocket Propulsion and Interplanetary Flight," A. V. Cleaver, A.R.Ae.S.
April 29th. to May 15th.—Paris Aero Salon.
April 30th.—No. 613 (City of Manchester) Squadron and A. V. Roe Ltd.: Air Display at Woodford airfield.
May. 2nd.—R.Ae.S. (Derby): "Lubrication of Aero Gas Turbines," J. G. Dawson, B.Sc., A.F.R.Ae.S.
May 3rd.—R.Ae.S. (Graduates and Students): "Notes on Fighter Development, 1936-1948," J. K. Quill, O.B.E., A.F.C.
May 6th.—Scientific Instrument Manufacturers' Association: Annual Dinner and Dance, May Fair Hotel.
May 8th.—Royal Aeronautical Society: Garden Party.
May 12th.—R.Ae.S. (Graduates' and Students' Section): "Pressure Cabins," D. Cardwell, B.Sc., A.C.G.I., A.F.R.Ae.S.
May 18th.—R.Ae.S. (Weybridge): Branch Members' Junior Prize Lecture.
May 21st.—Northamptonshire Aero Club: 21st Anniversary Air Display.
May 21st.—Aero Golfing Society: Summer meeting and "Flight," Trophy, Ashridge Course.
May 26th and 27th.—National Physical Laboratory: "Open Days," May 26th for representatives of industrial organizations and May 27th for members of university staffs and government departments.
May 28th.—Wolverhampton Aero Club: "At Home" and Air Display.

Together Again

Spirited Reunion of Former Members of the Royal Flying Corps and Royal Naval Air Service

LONDONDERRY House, Park Lane, London, presented an unusual spectacle last Thursday. Round about 6.30 there was a long queue filling the pavement in front of the old building, and there were good-natured shouts of "You get back to the tail of the queue." The occasion was the first reunion of former members of the Royal Flying Corps and the Royal Naval Air Service, from the merging of which grew, in 1918, the Royal Air Force.

When one comes to think of it, it is rather strange that such a reunion should not have been held until 31 years after the merging of the two Services, but it is a very good thing that Mr. Geoffrey Dorman should have had the idea last year, and that he should have been able to get together such a strong committee to organize the event. Gratitude to the committee was rightly expressed by more than one speaker.

The reception committee was composed of very distinguished former members of the R.F.C. and R.N.A.S., led by Marshal of the R.A.F. Viscount Trenchard, who was ably and amiably supported by Marshal of the R.A.F. Sir John Salmond, Air Chief Marshal Sir Robert Brooke-Popham, Air Chief Marshal Sir Arthur Longmore, Vice-Admiral R. Bell-Davies, Rear-Admiral Sir Murray Sueter, and Lt. Col. Sir Francis McClean.

Lord Trenchard proposed the Loyal Toast and read the text

"Flight" photograph.

"The Father of the R.A.F.," Viscount Trenchard, speaking at the R.F.C.-R.N.A.S. reunion.

"Flight" photographs.

(1) Air Chief Marshal Sir Arthur Longmore (right) talking to Mr. E. Keith Davies, one of the organizers and a pioneer pilot. (2) Marshal of the R.A.F. Lord Tedder, with Marshal of the R.A.F. Sir John Salmond and Lt. Col. Sir Francis McClean. (3) Lt. (A) R. G. R. Forsythe, R.N., and P/O. J. E. T. King, R.A.F., represented the younger generation. (4) A.Cdre. P. Huskinson has a word with A.V-M. Sir Charles Longcroft.

Together Again . . . . .

of a message of greeting sent to the King, wishing His Majesty a speedy recovery, and a reply from the King with good wishes for an enjoyable reunion. Lord Trenchard was glad to see so many of those who had laid the foundations of the R.A.F. in the R.F.C. and R.N.A.S., and mentioned specifically Murray Sueter, Robert Brooke-Popham, Arthur Longmore and Charles Longcroft. A strong R.A.F. could prevent another war, or, if war should come, could win it again.

Air Chief Marshal Sir Robert Brooke-Popham, who proposed the toast of the R.F.C., thanked the organizers for affording such a fine opportunity to renew old friendships. Many had sent messages regretting their inability to be present, and he read two of them, one from Mr. Churchill and one from General Doolittle.

Flying was a young man's job, Sir Robert said, but even the decrepit could do something to help. In the old days they were not troubled by such things as Mach Numbers on their Maurice Farmans, but they could help to pass on the tradition established in two wars. For instance, they could talk to airmen in trains—and to officers, if any of them could afford to travel first-class! They could also help the A.T.C.; there was a lot to be done for them. Sir Robert paid a tribute to the memory of General Sir David Henderson as the first Army officer to appreciate the importance of the air.

Rear-Admiral Sir Murray Sueter proposed the toast of the R.N.A.S.—and recalled that the Service started with one officer and one man. Then they had some small airships which did good work on convoy duties. It was Sir Francis McClean who lent his own aeroplanes to the Admiralty and thus made it possible for them to train at Eastchurch.

Sir Murray recalled how sometimes the R.N.A.S. had come to the aid of the R.F.C., a remark which was greeted with "Ohs!" from members of the R.F.C. The R.N.A.S. had lent the R.F.C. more than 100 Sopwith one-and-a-half strutters, engines and spare parts. He also referred to the placing of the first orders for large Handley Page bombers, and to the fact that the first torpedo was dropped by Sir Arthur Longmore and that later, in the Dardanelles, l'Estrange Malone led a flight which dropped three torpedoes and scored three hits.

It was much to be regretted that the first air V.C., Lieut. Warneford, could not have been spared to be present on this occasion, but they were glad to welcome the second, Vice-Admiral Bell-Davies.* "We old-timers," Sir Murray continued, "admire the work of the R.A.F.," and he referred to the Battle of Britain and the bomber offensive. At sea there were such fine events as Taranto, Matapan, and the sinking of the *Bismarck*.

Flotation for Winston

Sir Murray concluded by referring to the difficulties which the R.N.A.S. had in the beginning, and the great help Mr. Churchill gave as First Lord. On one occasion, he recalled, there was to be a meeting at the Admiralty, and there was no sign of Mr. Churchill. "Then I got a message," Sir Murray said, "and informed Their Lordships that the First Lord had turned over in a seaplane off Sheerness and was at that moment sitting on one float and Spenser Grey on the other."

Lord Tedder replied on behalf of the R.A.F. He pointed out that, without the inspiration, tradition, vision, courage, enthusiasm and gallantry handed down by the R.F.C. and R.N.A.S., the R.A.F. could not have played the part it did in the last war. A spirit of youth was one of our most precious things. He did not believe more than one per cent of those present had ever grown up, or would ever grow up. The R.A.F. was regarded as a troublesome child, but if it grew up he hoped it would never grow old in spirit. The unknown stretched out ahead as enticing and adventurous as ever, and our security rested on remaining second to none in the air.

Before the official reception Lord Tedder inspected a guard of honour provided by No. 291 Chelsea and Westminster Squadron of the A.T.C. Youth was also represented by the youngest Lieut. (A), R.N.—R. G. G. Forsythe, and by Pilot Officer J. E. T. King, R.A.F., the latest Sword of Honour Cranwell Cadet.

After the speeches, the gathering became very informal, and it was a happy thought to divide the bars into sections under names such as C.F.S., Upavon, Calshot, Eastchurch, Gosport, and Farnborough; this made it much easier to find old friends.

*[*We have to correct Sir Murray Sueter. The first air V.C. was Second Lieut. W. B. Rhodes-Moorhouse of No. 2 Sqn., R.F.C.*—ED.]

ANGLO-AMERICAN CONFERENCE PAPERS

A REVISED list of papers to be read at the second Anglo-American Aeronautical Conference (New York, May 23rd-June 4th) has now been made available, and shows a few alterations in comparison with the original programme published in *Flight* of March 17th. The papers have been arranged in chronological order of delivery, and it will be seen that, so far as possible, each session is being devoted to various aspects of one particular field. The complete list is as follows (initial letters indicate British or American authorship):—

MAY 24 (MORNING)

(B) *The Propeller Gas Turbine in Service*, by F. M. Owner (Bristol Aeroplane Co.).
(A) *Optimum Fields of Application for Air-consuming Aircraft Power Plants*, by W. G. Lundquist (Wright).
(A) *Recent Design Refinements in Turbojet Engines*, by N. Burgess and J. C. Buechel (G.E.C.).

MAY 24 (AFTERNOON)

(B) *Turbine-engined Transport Aircraft*, by G. R. Edwards (Vickers-Armstrongs).
(B) *Research on Helicopters at the R.A.E., with Special Reference to Stability of Multi-rotor Helicopters*, by H. B. Squire (Royal Aircraft Establishment).
(A) *Operational Experience with Helicopters*, by Clarence M. Belinn (Los Angeles Airways).

MAY 25 (MORNING)

(B) *Aircraft Materials from the Designer's Point of View*, by A. E. Russell (Bristol Aeroplane Co.).
(B) *Application of Materials from the Manufacturer's Point of View*, by Maj. P. L. Teed (Vickers-Armstrongs).
(A) Paper from Battelle Institute.

MAY 25 (AFTERNOON)

(A) *Aero-elastic Problems at Supersonic Speeds*, by A. Flax (Cornell Aeronautical Laboratory).
(B) *Life of Aircraft Structures*, by H. A. Wills (Council for Scientific and Industrial Research) (Australia).
(A) *American Structural Design Trends*, by G. G. Green (Consolidated Vultee).

MAY 25 (EVENING)

(B) *The Relative Merits of Auxiliary Power Systems:*—
Hydraulic, by H. G. Conway (British Messier).
Electric, by R. H Woodall (Rotax).
Pneumatic, by H. R. Haerle (Hymatic).
(A) *Aerodynamically Boosted Surface Control as Applied to the DC-6*, by O. R. Dunn (Douglas).

MAY 26 (MORNING)

(A) *High-speed Aerodynamics*, by W. Vincenti (N.A.C.A.).
(B) *Flutter Problems of High-speed Aircraft*, by E. G. Broadbent (R.A.E.).
(A) *Transonic Aerodynamic Results from Flight Testing of Dropped Bodies and Rocket Models*, by F. L. Thompson (N.A.C.A.).

MAY 26 (AFTERNOON)

(B) *Relative Efficiencies of Large Landplanes and Flying Boats*, by D. Keith-Lucas (Short Bros. and Harland).
(A) *Aerodynamic Efficiencies of Large Landplanes*, by G. S. Schairer (Boeing).
(B) *Operating Factors Affecting Design of Future Civil Transport Aircraft*, by C. Dykes (B.O.A.C.).
(A) *Utilization Factors and Maintenance of Civil Aeroplanes*, by Warren Albers (United Air Lines).

R.Ae.C. COMMITTEES

A RECENT announcement from the Royal Aero Club gives the constitution of its various committtees for 1949-50. Officials and membership of the principal committees are as follow:—

Club Committee.—President, Lord Brabazon. *Vice-presidents*: Capt. Sir Geoffrey de Havilland, Lord Gorell, Lt. Col. Sir Francis McClean, Sir Frederick Handley Page, the Duke of Sutherland. *Chairman*; Whitney Straight. *Vice-chairman*; S. Kenneth Davies. *Members*; Capt. K. J. G. Bartlett, Capt. H. S. Broad, Capt. C. W. Byas, R.N., Air Marshal Sir Roderick Carr, John Cunningham, Col. W. C. Devereux, Eric Greenwood, W. Humble, Capt. A. G. Lamplugh, Maj. R. H. Mayo, H. W. H. Moore, Maj. H. A. Petre, Maj. J. Stewart, C. F. Uwins, Frank Woodhead, W/C. N. H. Woodhead.

Private Flying and Air Touring Committee.—C. E. Berens, Capt. C. W. Byas, R.N., Lt-Cdr. J. G. Crammond, S. Kenneth Davies, E. S. Davies, A. D. Duncan, R. Kent, F. G. Miles, H. W. H. Moore, Maj. H. A. Petre, W. Guy Robson, H. M. Samuelson, Lawrence Swan, O. J. Tapper, J. C. C. Taylor, D. Ward-Campbell.

Records, Racing and Competitions Committee.—Capt. H. S. Broad, Capt. C. W. Byas, R.N., John Cunningham, W/C R. J. Falk, A. Goodfellow, E. S. Greenwood, W. Humble, G/C. J. Jeffs, Capt. A. G. Lamplugh, P. B. Mayne, Maj. R. H. Mayo, Lt-Cdr. J. Quill, F. Rowarth, S. Scott-Hall, C. F. Uwins, G/C. H. J. Wilson.

Stewards of the Royal Aero Club.—Lord Brabazon, Air Marshal Sir Roderick Carr, Lord Gorell, Lt-Col. Sir Francis K. McClean, H. W. H. Moore, Maj. H. A. Petre. The Duke of Sutherland, F. Woodhead.

Officials for Air Races and Records.—*Timekeepers*; J. W. Barber, A. L. Ebblewhite, Maj. Gen. A. H. Loughborough, L. H. Lunby, P. B. Mayne, A. G. Reynolds. *Handicappers*; W. Dancy, F. Rowarth.

Representatives at F.A.I. Conferences.—Capt. K. J. G. Bartlett (Air Touring Commission), A. F. Houlberg (Models Commission), Major R. H. Mayo, (Sporting Commission), Col. R. L. Preston (Air Touring Commission), Whitney W. Straight, (Vice-President of F.A.I.), P. A. Wills (Gliding Commission), Lord Ventry (Lighter-than-Air Commission).

An R.A.F. Postscript

Thoughts of a Long-service Engineer Officer on Morale and Recruiting

By SQUADRON LEADER H. R. BUNN, M.B.E., A.R.Ae.S.

IN the excellent series of articles and letters which have appeared recently in *Flight*, various authors have, from many angles, examined and dissected the R.A.F., its organization and its morale. Contributions have come from senior officers, National Servicemen, wartime aircrew, and many others, some of whom may have been qualified to express opinions, and others of whom have obviously been flogging their own horses. Good judges as these writers may be in their particular approach, it can hardly be admitted that very senior officers are necessarily the best qualified to assess the situation from the viewpoint of the rank and file (or even of junior officers); that National Servicemen, with their essentially civilian, short-time-airman's outlook, can really appreciate the position in relation to the regular airman; or that wartime personnel, excellent as their records may be, can have any conclusive conception of the needs of a peace-time air force.

IN the four months since "Flight" first commented on the problems of the peacetime R.A.F. in manning and morale a great many widely contrasted views have been expressed: articles and letters have been contributed by an Air Chief Marshal, a young National Serviceman and many men of intermediate rank.

It is, perhaps, fitting that the accompanying article should—for the present, at any rate—bring the controversy to a close, for it is the considered opinion of an officer who has risen from apprentice to squadron leader during 21 years of service and, as such, exhibits the unbiased viewpoint from which any summing-up should be made.

I do not necessarily claim that I am better qualified than any of these undoubtedly sincere analysts, but I *can* claim twenty-one years' Service experience, from aircraft apprentice, through the many years of aircraftman service once required to attain N.C.O. rank, and so to seven years as an Engineer Officer; this varied experience should have (even if it hasn't) given me a reasonably representative outlook. I think I can also claim that my brain has not atrophied into that state of "Service-mind" which is frequently deplored outside, and even inside, the Service. For this personal reason, therefore, I cannot help regretting that in the discussion there has been so much unqualified emphasis upon "discipline." To the rank and file the term has disagreeable connotations involving "square-bashing," spit-and-polish, and "jankers," and it can hardly be expected that this same rank and file will welcome any unqualified suggestion of increased discipline, for which they have a very much more expressive and distinctly Anglo-Saxon term. In case there should appear to be too much insistence upon this same rank and file, it would perhaps be as well to point out that the R.A.F. is composed largely of them, so from all points of view they are the most important factors in any consideration of organization and morale.

Aircrew and Airmen

I am afraid that I have little sympathy with the aircrew who are crying for their sergeants' stripes, crowns, and "fighting dogs" back again. I remember vividly (for I was one of them) the feelings of senior N.C.O. tradesmen—who had attained the honour, dignity and comfort of the Sergeants' Mess after many years in the ranks—when confronted with the pre-war direct-entry sergeant pilot, who frequently failed to appreciate the Mess, its traditions, and its accepted behaviour. I would, indeed, go further, and suggest that all airmen should come under a system of grading similar to that adopted with aircrew, and somewhat along the lines of the Navy with their classes of petty officers amongst tradesmen. By this method ability is rewarded on a progressive scale, and the pre-war soul-destroying wait for promotion at least modified, if not done away with entirely. As in the Navy, the lower gradings need not carry disciplinary authority, this being vested in the airman after he has attained the equivalent of senior N.C.O. rank and after a course in leadership. Below this grade, seniority can always carry authority, if duly recognized, as it did in the past, when, on many stations, L.A.C.s above a specified seniority acted as guard commanders and were recognized as such. More important, those with disciplinary authority will have attained a degree of experience comparable with that of the pre-war senior N.C.O. without that long period of static waiting.

Time will replace the disgruntled aircrew, now suffering from the accelerated promotion of the war period, in the same way as it will teach by experience, or replace by selection, the officers against whom complaint has been made. As a matter of fact, I feel that these complaints are probably exaggerated, and expressed by the voluble few who expect to be wet-nursed in any walk of life. In some ways the system is to blame for any lack of a sense of responsibility in the officer towards his men. Planned maintenance and servicing have made the technical officer responsible for all tradesmen, whether in flights or workshops, and have removed the direct association between air and ground crews and flight commander and flight personnel. The present system, designed for war conditions, is fully efficient only if resources must be exploited to the full. With the exception of the artificial (and, we hope, passing) phase of Operation Plainfare, the Service is limited in its operations for reasons of economy, so that its aircraft are never employed at anything like full capacity. For peace-time conditions, therefore, it should be possible and politic to revert to a modified form of the pre-war flight-, squadron- and unit-workshop system and so to restore the intimate association of ground crew and aircrew.

Exaggeration?

Even so, one still feels that this alleged lack of responsibility among officers is somewhat exaggerated, for during the war many welfare services and similar innovations were introduced which were not in existence (and, be it said, were not considered necessary) before the war. This difference in outlook is, of course, probably a reflection of a day and age in which every citizen looks to the state for everything and the old British self-reliance is at least slumbering. If these stories are indeed true, I wonder what has happened to the old-time station commander?

There is certainly an important angle in connection with pay, allowances and married quarters, but one wonders if these grumbles are not also exaggerated. Pay and allowances during the last fifteen years have improved immensely, and I can assure any serving man that the crippling taxation appears to hit me much more now that I am a civilian than ever it did when I was in the Service. As to married quarters, although I admit, in view of the general housing shortage, the problem is aggravated, those of us who can remember the pre-war days will also remember that one had practically to wait for some senior member to die and vacate quarters before qualifying for these delectable residences; and they can also remember that each peaceful haven was not always as delectable as it appeared from the outside looking in.

Finally, a word about the value of the National Service-

R.A.F. Postscript . . . .

man in the R.A.F. It must be admitted that short-service, untrained personnel are practically useless to a technical force such as the R.A.F., but there is a long-term solution to this problem and to the problem of replacement of present personnel in civilian aviation. If a far-sighted scheme of apprenticeship for civil aviation could be inaugurated, with the National Service period as a sort of extended apprenticeship guaranteed for the youngster who has been undergoing training as a tradesman, there would be far more young and bright recruits for the field of aviation generally. There is surely no reason why certain types of trade training with a civilian flavour should not be approved by the R.A.F. Trade Test Board; the partially trained civilian aircraft apprentice could then be guaranteed call-up into the R.A.F. (rather than one of the other Services) and, after a short period of Service "inoculation," mustered to one of those trades. When his National Service period was concluded the trainee would return to his civil apprenticeship for finishing. Both the R.A.F. and civil aviation would thus be assured of a steady flow of suitably trained personnel.

The differences which exist between the requirements for the two spheres could be adjusted to assure the success of the scheme, and one cannot help feeling that the National Serviceman who appreciated that he was performing a really useful period of service would be more inclined to carry on in the Service as a volunteer regular. In any case, much more could and should be done to ensure reciprocal action between R.A.F. and civil aviation, both of which are, in their respective ways, equally important to the national prestige.

It is, perhaps, appropriate to close with the thought that the conditions obtaining in the days of 1925-1935 were not achieved until some seven to ten years after the first world war; thus it must be accepted that a fairly long period must elapse before airmen and officers can once more be selected and trained up to the general and technical standard then achieved, to produce that pride in craftsmanship, that mutual respect and self-respect that welded all ranks of "the 30,000" into the finest air force in the world.

Incidentally, in case any reader should wonder why I, with an obvious love for it, left the Service after so many years, I should perhaps add that I was found medically unfit after the war, and thus had to go out into the cold, cold world and start to earn my living in what had previously appeared to be a very attractive "civvy street." Two and a half years of it have completed my disillusionment.

MAINTENANCE AT A MINIMUM

D.H. Goblin Completes a Second 500-Hour Test Run

DURING 1948, representative types of turbojets and turboprops passed a series of exceptional endurance tests initiated by the Controller of Supplies (Air), Air Marshal Sir Alec Coryton, in order to assess and demonstrate the reliability of modern British gas turbines.

One of the most severe of these tests was that to which a de Havilland Goblin was subjected; briefly, it constituted the equivalent of 462 operational flights entailing 500 hours' running (an account appeared in *Flight* of August 19th, 1948). The encouraging results achieved led to a proposal that the *same* D.H. Goblin should attempt a repeat performance, and to this Sir Alec agreed. The experiment was duly made—it concluded on March 31st—with the very satisfactory results summarized below. First-test figures are given for comparison.

Following the original 500-hour run the test Goblin had been stripped and the major components found to be in good order. Those which were in condition for the repeat 500-hour test included the impeller; turbine disc and blades; mainshaft and bearings; front and centre casing; diffuser and conical backbone member; combustion-chamber outer casings; and certain components of the two accessory-drive units. There had been some fouling of the burners, due to scale from the underground fuel-storage tanks, and there had been cracking of the flame tubes.

In service, flame tubes are changed after 200 hours' running, but in the first test they had stood up to the whole 500-hour run. Fragments from the flame tubes passing through the turbine had caused superficial damage to the nozzle box and turbine blades, but it was insufficient to justify replacement.

MAINTENANCE ON TEST RUNS

	0-500 hr	500-1,000 hr
Test cycles	462	462
Oil consumed	56 gall	60 gall*
Maintenance	13.2 man-hours	14.25 man-hours + 33.5 man-hours for change of flame tubes.

* Increase owing to slight leakage as test progressed.

At the completion of the second test: left to right: Air Marshal Sir Alec Coryton, Mr. Burke, Mr. Brodie, Major Halford, Mr. Buckingham, Mr. Arscott, Dr. Moult.

The static-blade assembly, however, was replaced and a new diaphragm fitted to the inner cone of the tail pipe. During the second 500-hour run it was decided that one change of flame tubes should be made at 300 hours. Incidentally, the flame tubes used on this engine are of a type which has now been superseded, and those at present in production are more durable. The change of tubes, which must fairly be included in the man-hours maintenance figure, is responsible for 33½ hours of the work.

The achievement reflects great credit on the de Havilland Company, and its importance to the Service and to those commercial operators who are considering the use of gas turbine power on the air routes of the world should not be underestimated. In wartime, and neglecting considerations of the life of a fighter aircraft, 500 hours' operations would usually cover a period of up to six months. Using the test figures as a basis, only 2.4 man-hours per month would be required for maintenance of a Goblin engine in a fighter. At a time when the R.A.F. is so short of maintenance personnel, gas-turbine reliability becomes a factor of major importance.

As the prototype D.H. 106 Comet airliner is now nearing completion it is a point of interest that its four Ghost turbojets are, though larger, basically similar to the Goblin, and it is reasonable to expect that these power units will be capable of emulating the performance of their smaller stable-mate.

STRATOCRUISER HERE

Pan American's "Flying Cloud" Comes to London Airport

NAMED *Flying Cloud*, the fourth aircraft of an order for 20 Boeing Stratocruisers to be delivered to Pan American Airways, and the first example of the type to be seen in this country, landed at London Airport at 1325 hours last Monday.

It had originally been intended that the flight from Gander to London should be made direct, but a reduced favourable-wind component made a landing at Shannon necessary. The Gander-Shannon leg took seven hours. When the scheduled service begins on June 1st passengers will be flown direct from Heathrow to Idlewild in 12 hours.

The Stratocruiser's arrival at London Airport was further delayed by servicing to its port outer engine, which had been out of action when the aircraft touched down at Shannon at 0420 hours on Monday. Maintenance crews were reported to have experienced difficulty in re-fitting engine cowlings in the prevailing gale.

In charge of *Flying Cloud's* crew of 17, many of whom were, of course, supernumary, was Command Captain R. D. Fordyce, with Capt. F. I. Jacobs and Capt. C. R. Titus as first and second officers. Despite its delayed arrival, a large number of people waited to welcome the Stratocruiser, including those members of the public responding to a widely advertised invitation to inspect the new airliner.

Impressions gained in a brief examination of the interior were that the upper deck is extremely spacious in spite of the large number of seats, while in the lower half of the "double-bubble" fuselage the cocktail lounge, with a large mirror, appeared extremely attractive; it is upholstered in red, grey and blue.

Pan American officials constituted the passenger list, some forty strong. Among them was Mr. Willis G. Lipscomb (vice-president, traffic and sales), who stated that Pan American Airways' goal was to carry people, cargo and letters in great numbers—that was, mass air-transportation for the average man at fares he could afford to pay. The world's first low-cost tourist-class fare was begun recently between New York and Puerto Rico, with the result that within five months the number of scheduled air passengers between Puerto Rico and New York was more than trebled.

Late this summer, he said, sufficient equipment would be available to enable P.A.W.A. to offer low-cost tourist-class service to Europe and to the Orient as well as to South America. Tourist-class fares between the United Kingdom and the United States could be at least 30 per cent below first-class rates. There was no reason, therefore, why a tourist-class air trip between Europe and the United States this autumn should cost more than $225 (approximately £56). That was the Pan American objective, subject to the concurrence of the Governments concerned. They would not carry two classes of passengers on the same aircraft.

Six Stratocruisers, incidentally, are on order for B.O.A.C., which expects delivery of the first during November. A description of the aircraft, with reference to B.O.A.C. requirements, was published in *Flight* of January 27th last.

"Flight" photograph.

Super Clipper: The luxurious, fast, and expensive (£375,000) Boeing Stratocruiser Flying Cloud of Pan American World Airways, the first of its type to visit the United Kingdom, touching down at London Airport last Monday afternoon.

MENTION PERMITTED

THE existence of a turboprop-powered version of the Westland Wyvern strike-fighter may now be disclosed. Designated the Wyvern T.F.2, it is powered by an Armstrong-Siddeley Python of unstated power output. The maximum power output so far admitted for this unit is 4,100 h.p. Official mention has previously been made of another turboprop-powered strike-fighter, the Westland W.35, with Rolls-Royce Clyde.

The mark-number F.8 has been allotted to a later variant of the Meteor. A "long-nose" Meteor development, with increased fuel tankage, was announced in 1947.

COLLEGE OF AERONAUTICS CELEBRATION

THE College of Aeronautics, established by the Government in 1946 to provide high-grade engineering, technical and scientific training in aeronautics, celebrated its first annual dinner last Friday. There was an excellent and representative gathering, including many guests, in the Senior Common Room of the College, which is situated at Cranfield, some ten miles south-west of Bedford. The toast list was as follows:—

"The College of Aeronautics."—Proposed by Sir Robert S. Wood, C.B., K.B.E.; response by the Principal, E. F. Relf, C.B.E., F.R.S.

"The Senior Common Room Society."—Proposed by P. G. Masefield, M.A.; response by the Chairman, S. V. Colbran, M.A.

"The Guests."—Proposed by Sir Frederick Handley Page, C.B.E.; response by Prof. G. Temple, F.R.S.

NEW C.O. FOR No. 615

SQUADRON LEADER PETER DEVITT has been appointed to command the County of Surrey Squadron of the R.Aux.A.F., vice S/L. Kellett. Before the war Peter Devitt was a flight commander in No. 600 (City of London) Squadron. He fought in the Battle of Britain, and, later, served as a Group Captain on A.V-M. S. F. Vincent's staff in Burma.

Appropriately, he is a Surrey man—his home is at Limpsfield—and a member of Lloyd's. Gliding is one of his pastimes and he owns an Olympia sailplane which he keeps at Redhill, where he is a member of the Surrey Gliding Club.

AERONAUTICAL GOLF

THE match between the Aero Golfing Society and the R.A.F. Golfing Society, played at the Royal Wimbledon Golf Club on March 15th, resulted in a win for the R.A.F. team. Individual scores were as follows:

Aero Golfing Society			R.A.F. Golfing Society		
H. G. Bentley ...	1	(6 and 5)	F/L. J. Niven ...	0	
A. Michell-Clarke	1	(3 and 1)	S/L. F. C. Roe	0	
Douglas Bader...	1	(3 and 2)	G/C. G. F. Macpherson	0	
W. G. Metcalfe	0		A. Cdre. H. D. Jackman	1	(2 and 3)
Lord Brabazon	1	(4 and 2)	S/L. H.E. Beardshaw...	0	
P. Q. Reiss	0		W/C. R. D. I. Scott	1	(7 and 5)
T. F. Mitchell	0		F/L. G. Hovil	1	(3 and 1)
A. E. L. Skinner	½		G/C. K. A. Jackman	½	
	4½			3½	
H. G. Bentley ...	0		F/L. J. Niven ...	1	(7 and 5)
Douglas Bader...			S/L. F. C. Roe		
Lord Brabazon	0		G/C. G. F. Macpherson	1	(6 and 5)
A. Michell-Clarke			A. Cdre. H. D. Jackman		
P. Q. Reiss	1	(5 and 3)	S/L.-H. E. Beardshaw...	0	
W. G. Metcalfe			W/C. R. D. I. Scott		
A. E. L. Skinner	0		G/C. K. A. Jackman	1	(4 and 2)
T. F. Mitchell			F/L. H. Hovil		
	1			3	

Result:
Aero Golfing Society, 5½; R.A.F. Golfing Society, 6½.

Following the competition members of the two societies were entertained to dinner by *Flight* at the Aviation Centre, Londonderry House. Mr. F. G. Montfort Bebb welcomed the guests and Sir Frederick Handley Page replied.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

PIONEER SQUADRONS

"First in Time"

YOUR correspondent S/L. Collinson (March 17th) may sidetrack, draw red herrings across the trail, and quibble until he is blue in the face; but how he can quite casually quote No. 2 Squadron as the "premier" squadron of the R.A.F. beats me. The *Shorter Oxford English Dictionary* defines "premier" as "first in time."

As an ex-C.O. of *the* premier squadron of the R.F.C. I can only offer him my sympathy for having been posted to the wrong unit!

HUBERT R. ALLEN, S/L.

The Hague, Holland.

OLD TRAINERS

More About Tigers for the Clubs

IT was pleasing to read Mr. Lewis G. Cooper's letter, "Cast-off Trainers wanted by Clubs," in *Flight* dated March 17th. In spite of the Admiralty's rejection of my plan for the use of six Tiger Moths by the R.N.V.(S.)R., Air Section, our members still believe that this type of machine holds a certain amount of training value, and we are glad to see there are others who agree with us.

If some such scheme as has been suggested by Mr. Cooper could be put into effect, perhaps the clubs receiving the machines would agree to allow R.N.V.(S.)R. Air Section members to make use of them for a nominal fee sufficient to cover expenses of flight. If some suitable arrangement could be agreed upon, I feel sure that many R.N.V.(S.)R. members would be only too glad to become full members of the various flying clubs. Could not such an arrangement be put forward as an additional reason why these surplus Tiger Moths should be handed over to the clubs?

SIMON WARRENDER,
Organizer, R.N.V.(S.)R. Air Section.

London, W.1.

CO-OPERATION

P.A.A., Boeing and the Stratocruisers

IN view of the arrival in this country of the P.A.A. Boeing Stratocruiser perhaps it may be permissible for one who knows the background story to give some facts about the remarkable teamwork between the manufacturer and customer concerned—Boeing and P.A.A.

Let us go back to 1941 when P.A.A.'s specification called for a new long-range airliner carrying 17,500 lb payload, with a range of 4,500-5,000 miles, and top speed of 375 m.p.h. Between 1941 and November, 1945, P.A.A. examined closely the plans of the leading American manufacturers of transport aircraft, and later entered into provisional contracts with some of them for a post-war long-range airliner for its world-wide routes. It was subsequently found that the best compromise between (a) availability after the war; (b) delivery dates after the cessation of hostilities; (c) cost per unit; (d) speed; and (e) the best economical payload, resulted in a truly commercial development of the Boeing XC-97 which had been produced for the U.S.A.F. back in 1944.

The true partnership began in June, 1944, when Boeing proposed to fit 2,200 h.p. motors, a fuel capacity of 5,700 U.S. gal., 120,000 lb gross weight and top speed of 280 m.p.h. Thereupon P.A.A. proposed that Boeing should fit the then-new 3,500 h.p. P. and W. Wasp Majors, with corresponding increases in fuel, speed, payload, range and gross weight. As a result, Boeing's new specification showed that with these changes the fuel tankage could be increased by 1,200 gal. by installing additional bladder cell-type wing tanks, and the new gross weight would be 130,000 lb. A further fuel increase of 120 gal. was made available, in a specification dated 25.11.44, which was helpful to P.A.A., but discussions were by no means completed. Then Boeing proposed the installation of a mechanical-type supercharger for the engines as it was thought this would be less complicated for airline use than the General Electric turbo-supercharger already used on Fortresses, B-29s and Liberators. P.A.A., however, decided on the latter because of its wartime experience gained on Liberators. Another specification issued by Boeing increased the cargo capacity from 675 to 910 cu ft; this was again at the request of P.A.A., who foresaw great increases in the post-war field of the air cargo business.

P.A.A. were still not satisfied with these improvements in payload and fuel capacity, and requested that fuel be increased from a total of 7,055 to 7,215 U.S. gal. Gross weight was accordingly increased from 130,000 to 135,000 lb. Again, P.A.A. were still not satisfied with the improved figures. The last and final specification, issued by Boeing on 28.11.45, showed an increase of yet another 400 gal. of fuel which the manufacturers found could be accommodated in two further extreme outboard wing tanks.

This series of negotiations had thus resulted in almost a different aeroplane internally, although externally the Type 377 remained practically unchanged except for an additional 5ft which was added to the tail unit to improve manœuvrability. The teamwork of manufacturer and customer had increased the payload by almost 10,000 lb, the gross weight by 22,400 lb, and speed from 280 to 340 m.p.h. Actual gross weight rose from 120,000 to 142,400 lb.

D. M. P.

Prestwick, Ayrshire.

BOMBER COMMAND REUNION

A "Shattering" Bill

I HOPE ex-F/S. N. Hooper will not consider that he is being "pranged" (as he feared) by the organizers of the Bomber Command Reunion if I suggest to him that the reason for the alleged early closing of the show may be found in his criticism of the "boys."

As a matter of fact, there were still some glass-breakers in the Albert Hall after 11 p.m. If we *had* closed earlier we might have saved ourselves from having to pay a bill of over £100 for damages.

ALEX THORNE,
Pathfinder Club.

London, W.1.

THE KING'S CUP RACE

A Plea for Its Revival

IT is years since the King's Cup Race was run. On the last occasion of any importance a turning-point was arranged in Eire, with what were said to be happy results. Why not revive it?

It would, I suppose, have to be run for different types now, but why not a race for club trainer, general trainer, private owner and tourer types, limited to five seats or so? This or the next Government must surely do something for the clubs and such a race would revive interest in them and private ownership. It would advertise for export. A turning-point in Eire would do good politically.

The old King's Cup used to be run in September. What about it?

JAMES HEMBROW.

Knutsford, Cheshire.

THE 600 M.P.H. BOMBER

Another Viewpoint

IT was suggested by Mr. Granville Bradshaw, in his letter published in *Flight* of March 24th, that the present policy of creating a bomber force with an average speed of 600 m.p.h. may be mistaken in view of the development of atomic weapons. The idea that *all* other means of warfare will be rendered obsolete is as mistaken as that which supposed that the development of the aeroplane meant the immediate uselessness of the tank.

It is certain that valuable machines and men will be required to carry "the comparatively harmless kind of bomb we were using at the end of the last war" in order to obliterate pinpoint and somewhat larger targets, although we trust they will not be "wasted." It is not desirable to devastate a whole region by atomic methods just to destroy a bridge (for instance) behind the enemy's forward area if it is expected to occupy that region with one's own men in the near future (whether these men are brought up by ground or air transport). No doubt a pilotless and crewless atom-bomb "delivery plane" will be used for attacking those large bases and concentrations for which the "blockbuster" was designed during the war, and long-range radar will come into its own; but while defending air forces have fighters capable of near-sonic speeds, let us continue to step up the speed of our bombers.

E. CHAMBERLAIN.

Brighton, Sussex.

"Flight" photograph.

FOR THE FLEET: Service versions of the Vickers-Supermarine Attacker, now in production for Naval Aviation, though remaining externally similar to the prototype shown, will have folding outer wings. The Rolls-Royce Nene 3, of 5,000 lb static thrust, will be installed.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

New R.A.F. Chaplain

THE REVEREND LESLIE WRIGHT has been appointed Chaplain-in-Chief to the R.A.F. in succession to the Rt. Rev. J. A. Jagoe, C.B., C.B.E., M.A., D.D., K.H.C., who retired on March 31st. Dr. Jagoe was recently consecrated as Lord Bishop of Bermuda.

The new Chaplain-in-Chief, who is 49, was ordained in 1934, and was commissioned in the Chaplain's Branch of the R.A.F. two years later. During the early part of the war he served in the Western Desert and Greece, where, as Senior Chaplain, he was mentioned in despatches. After the evacuation of Greece he became Senior C. of E. Chaplain to the Rhodesian Air Training Group. Since the war he has served in both the Far East and Mediterranean Commands, returning to England in May, 1948, to become Assistant Chaplain-in-Chief to Coastal and Reserve Commands.

June Air Exercises

A SEVEN-DAY test of air defences, to be held early in June, will be the largest since the end of the war. Lessons learnt during Exercise *Dagger*, held last September, will be applied by both attacking and defending forces. Fighter Command H.Q. at Stanmore will control the defending squadrons, including units of the R.Aux.A.F. Day and night "raids" will be made by aircraft of Bomber Command and U.S.A.F. B-29s.

On June 30th, the four Western Union Navies—those of Britain, France, the Netherlands and Belgium—will begin combined manœuvres lasting until July 8th. The exercises will emphasize defensive unity in protection of convoys from submarine and air attack. Bombers, fighters, reconnaissance and strike aircraft of the four powers' air forces will also participate.

Admiral Sir Rhoderick McGrigor, K.C.B., D.S.O., will be in overall command of the exercises, flying his flag in the carrier H.M.S. *Implacable*. Other carriers likely to take part in the manœuvres are the *Theseus* and *Vengeance*, and the French and Dutch ships *Arromanches* and *Karel Doorman* (formerly H.M.S. *Colossus* and H.M.S. *Venerable*).

Air Emissaries

REPRESENTATIVE of Transport Command's latest equipment, a Hastings and a Valetta left Brize Norton, Oxford, on April 1st, for a three-month liaison visit to Canada and the United States, where the air-transport support methods of the R.C.A.F. and U.S.A.F. will be studied. On the same day a Lincoln from the Central Bomber Establishment left Marham, Norfolk, for a similar visit to North America. A C.B.E. liaison team will spend a month discussing bomber tactics and theory with the R.C.A.F. and U.S.A.F.

Accident Return

TRANSPORT COMMAND'S monthly return of accidents shows that 3,000,000 passenger-miles were flown by R.A.F. passenger-carrying aircraft during January, 1949. There was one fatal accident during this period; one crew member was killed and a passenger reported missing.

A.T.C. in the Commons

INCREASED encouragement for the Air Training Corps was demanded by a former director of the Corps, Sir Wavell Wakefield, M.P. for St. Marylebone, in the House of Commons on March 21st. Sir Wavell claimed that one of the reasons for the R.A.F.'s present shortage of skilled men was neglect of the A.T.C. in 1945 and in succeeding years. He urged that the most promising of cadets should be given an opportunity to learn power flying through the clubs, which would require greater Air Ministry support than is now being given. Cadets trained to A licence standard would be first class material.

S/L. Kinghorn (Great Yarmouth) also referred to the value of the flying clubs.

SWISS VISIT: The R.A.F. ice-hockey team concluded its tour of Switzerland by a visit to Zuoz College, Engadine, where it played against the school team. The banner above bears witness to the warm reception.

Service Aviation . . . . .

and quoted as evidence the wartime record of members of the Midland Bank Flying Club, which had a total membership of 272, including 88 non-flying members. Of this total, 223 served in the R.A.F., gaining between them 28 D.F.C.s and two bars, seven A.F.C.s, seven D.F.M.s and nine M.B.E.s.

Australian Air Lift

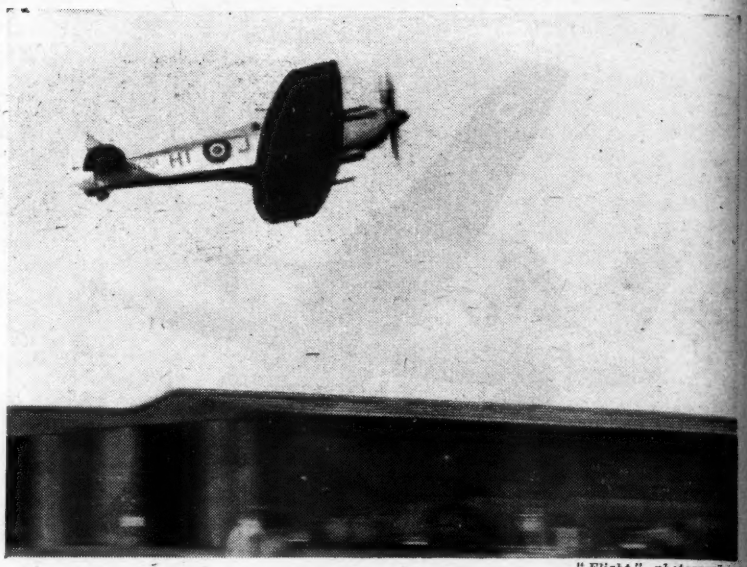
EXCEPTIONALLY heavy rains in New South Wales and South Australia, causing overflowing of six rivers, have necessitated a daily "air lift" of supplies to marooned people. Dakotas of the R.A.A.F. are used to parachute food and medicine on to dry patches in the flooded areas.

R.A.F. Appointments

THE Senior Air Staff Officer of Maintenance Command, A.V-M. F. N. Trinder, C.B.E., has been selected for appointment as the next Director-General of Equipment at the Air Ministry, in place of A.V-M. T. E. Drowley, C.B., C.B.E. The appointment will take effect on or about September 1st this year.

Before going to Maintenance Command in March, 1947, A.V-M. Trinder was with the Air Division of the German Control Commission, where he had been largely concerned with the disarmament of the Luftwaffe. He was on the plans staff of S.H.A.E.F. from its formation, and was earlier at the headquarters of the A.E.A.F. A.V-M. Trinder is 53, and was commissioned in the Stores (now the Equipment) Branch of the R.A.F. in 1920.

A. Cdre. T. B. Prickman, C.B.E., is to be Director of Combined Operations (Air) at Combined Operations H.Q., in succession to A. Cdre. N. L. Desoer, C.B.E. Until recently, A. Cdre. Prickman was Senior Air Liaison Officer with the United Kingdom Services Liaison Staff, and air adviser to the High Commissioner in Australia. During the Battle of Britain he commanded the fighter sector and station at Kenley. Born in 1902, he was commissioned from the R.A.F. College, Cranwell, 21 years later.



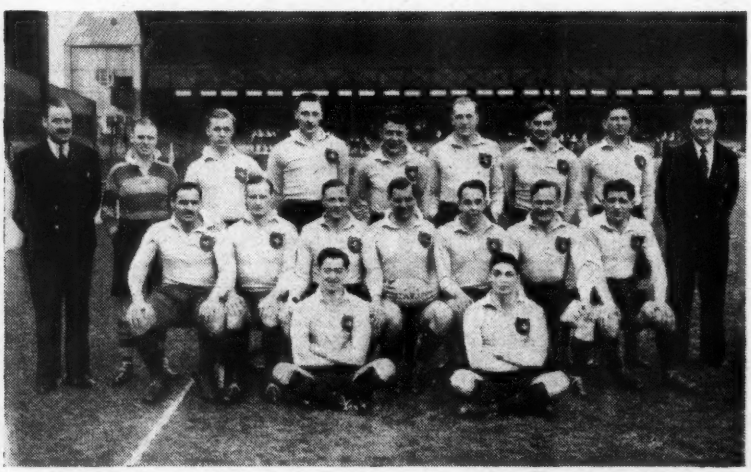
"Flight" photograph.

LAST LOOK: Seen over the hangars at Hendon is one of the Spitfire 16s of No. 604 (County of Middlesex) Squadron, before flying to its new base at North Weald. As related in last week's issue, both 604 and 601 (County of London) Squadrons transferred to North Weald on March 27th.

Fighter Control Camps

OVER 2,000 part-time members, 750 men and 1,300 women, of the R.Aux.A.F. fighter control units will attend their first summer camps at R.A.F. stations this year. Each camp will last a fortnight, the first opening on June 4th, and the last on August 27th. A list follows of the stations concerned, together with the units allotted to each:—

Felixstowe: No. 3611 (West Lancs) F.C.U., June 18th; No. 3509 (Staffs), July 2nd; No. 3602 (Glasgow), July 16th; No. 3506 (Northamptonshire), August 6th; No. 3604 (Middlesex), August 27th. **Middle Wallop:** No. 3620 (Norfolk), June 18th; No. 3504 (Notts) and No. 3500 (Kent), July 2nd; No. 3507 (Somerset) and No. 3619 (Suffolk), July 16th. **Coltishall:** No. 3505 (E. Riding), June 4th; No. 3603 (Edinburgh), July 2nd; No. 3608 (N. Riding), July 16th.



R.A.F. RUGBY: After drawing with the Army in the Inter-Services Rugby Tournament, the Royal Air Force team, seen above, will share the title. A description of the game was given in Flight *of March 31st.*

R.A.F. Permanent Commissions

GENERAL DUTIES BRANCH.

Squadron Leaders: P. S. Gordon, B. J. Hooper, D.F.C., J. D Kirwan, D.F.C., G. Shorrock.

Flight Lieutenants: D. N. P. Batty, J. Beecroft, D.F.M., E. F. Brown, D.F.C., P. W. Budd, L. A. A. Butler, I. Cay, D.F.C., R. A. Clift, J. M. Cooke, W. A. M. Dunjoy, A.F.M., J. W. L. Dunn, W. A. Gill, D.F.C., S. Greenhow, M. L. Hamilton, D.F.C., A. C. Heath, J. T. Hitchings, N. E. Hood, H. L. Holliday, D.F.C., S. P. Johnson, D.F.C., B.E.M., W. M. Kelly, D. O. Luke, R. B. McGowan, N. J. Steer, J. Townson, L. West.

Flying Officers: R. J. Gaywood, A. V. Godfrey, F. H. Hicks, W. J. Hunter, E. A. Knighton, R. S. Laurie.

TECHNICAL BRANCH.

Squadron Leaders: S. F. G. Hussey, J. R. W. Wright.

Flight Lieutenants: J. J. F. Long, T. J. Thomas.

Flying Officers: I O. Morris, K. C. H. Whiley.

EQUIPMENT BRANCH.

Flight Lieutenants: W. E. Collingwood, D.F.M.

Flying Officers: F. W. B. Duckworth, G. A. Fess, W. J. Gash, E. V. Hughes, A. J. Spence.

SECRETARIAL BRANCH.

Flight Lieutenants: J. Bradley, M.M., R. J. Reynolds, D.F.C., D.F.M., J. Slater, D.F.C., J. W. Wood.

Flying Officers: S. J. Davies, J. A. G. Federice, D. R. Perrin, D.F.C., A. Hagan, D.F.C.

AIRCRAFT CONTROL BRANCH.

Flying Officer: A. M. Warren.

EDUCATION BRANCH.

Flight Lieutenants: J. H. Chapman, B.Sc., L. Dent, M.A., N. T. Griffiths, B.Com., L. W. Marshall, B.Sc., J. A. Wilson, M.A.

Reunion

THE fourth annual reunion of the Headquarters Bomber Command Association of Officers is being held at Bomber Command H.Q., R.A.F., High Wycombe, Bucks, on Saturday, May 28th, 1949. Members who have not received details of the reunion may obtain them from the hon. secretary of the Association at the above address.